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VIEWS, NEWS AND INTERVIEWS.

Here's an encouraging sign of the times. A well known electrical manufacturer writes to the ELECTRICAL REVIEW as follows: "In regard to your kind invitation to contribute a descriptive article, I should like very much to do it, but the trouble is that the days in this latitude are only 24 hours long, and I believe I work about 16 or 18 of them. I am just turning it over in my mind whether or not it will not be better to move out to the Arctic circle, where the days are six months long."

The Court of Appeals of New York State has affirmed a judgment for $2,800 in favor of William Benthim as administrator of August W. Benthim against the New York Central & Hudson River Railroad Company. The deceased was employed as a fireman on a freight engine of the railroad named, and was killed between Buffalo and Syracuse, N. Y., on the night of July 8, 1895, while looking out of the engine cab for the purpose of ascertaining whether a journal on the car was smoking. Death was caused by the fireman's head coming in contact with a telegraph pole owned by the Western Union Telegraph Company. The pole, although 49 inches from the track, measured on the ground, leaned toward the track until there were but four inches of space between it and the side of the locomotive upon which the deceased stood, at the height of his head. There was unoccupied land upon which the pole might have been set 12 or 13 feet away from the track. The decision involved, in effect, the fact that the railroad company was negligent in permitting the pole to stand in the position in which it did.

An interesting item of news comes from Brunswick, Me., to the effect that an electric railroad syndicate has secured control of a number of the electric railroads in the state of Maine. The syndicate is said to be interested in a scheme to have an electric line from Portland to Boston, and it is predicted that within three years an electric road will be in operation between those cities. It is feared that the ambitious schemes of the syndicate will precipitate a great railroad war in New England. It is believed the Boston & Maine Railroad will fight the syndicate.

This story is told of Maurice Barrymore, an actor who is credited with a pretty wit. A friend of his, who had recently acquired religion, met Barrymore on the street and said: "Well, Maurice, and how is it with your soul?" "Why, old boy, to tell you the truth," replied Barrymore, "I haven't heard from it lately—all my wires are down."

A number of electrical engineers, working in conjunction with the Decoration Committee of the Greater New York Charter Day Celebration Committee, have planned a number of novel effects in illuminations. It is proposed to arrange searchlights in the manholes along Broadway in such a manner that the rays of light from them extend up perpendicularly.

FIG. 1.—A NEW TYPE OF ELECTRIC LAUNCH.

The lights will be so arranged that the rays will show American flags with the unions uppermost, apparently reaching high in the air. There will be similar displays along important thoroughfares in Brooklyn and in the other boroughs. There will be prizes for street illuminations and house decorations. Electric balloons will be used.

Mr. Henry S. Kearny, Commissioner of Public Buildings, Lighting and Supplies of New York city, has appointed Francis J. Fitzpatrick Chief Inspector of Overhead Wires in the borough of the Bronx, at a salary of $1,500 a year.

FIG. 2.—A NEW TYPE OF ELECTRIC LAUNCH WITH AWNING.

It is said that it will soon be possible to travel by trolley cars from the center of the city of Chicago to La Porte, Ind. The Valparaiso, Flint Lake & Chicago Electric Railway has been granted a franchise by the Board of County Commissioners at Valparaiso, and the company will, it is said, build a line connecting Hobart, Whiting, East Chicago and Hammond with electric cars. The capital stock of the company is $50,000.

A New Type of Electric Launch.

Boating in its perfection is emphasized in a new type of electric launch, embodying comfort, ease and luxury, built by the Electric Launch Company, of New York city. The usual side seats are discarded, and entire boat space furnished with easy chairs, upholstered divan, small cane table, and racks for books and magazines, the floor being polished and covered with rugs.

These marked features are made possible by the placing of all motive power (storage batteries and motor) entirely beneath the floor, which not only insures stability, but cleanliness and noiselessness.

A portable awning, having easily adjustable storm curtains, covers the seating space. Sometimes the awning is made to cover the entire boat; then both decks are cushioned, and the after deck fitted with high brass railing, which, when provided with pillows, makes a comfortable lounging place. In other cases the after part of the seating space is surrounded with railing and upholstered cushion and the seat enlarged to produce the comfort of a divan. The compartments beneath each deck may be fitted with refrigerators and lockers for supplies and refreshments for a day's cruise. In rough weather service the chairs and table can be easily lashed to floor rings provided for such purpose.

A powerful searchlight can be operated by current from the batteries, and so contribute largely to the pleasure of evening excursions, especially at such resorts as the Thousand Islands and on mountain lakes.

Each launch has a battery capacity for a continuous run of four or five hours at full speed, or six to seven hours at little less speed, but is capable of much higher speed rates for short spurts. A full recharge requires from four to six hours, depending upon previous service.

These boats are built in several sizes, from 22 feet to 36 feet in length, finished in ash, oak, cherry, mahogany or light woods, with deck

trimmings and furnishings to suit the individual tastes of purchasers, and are especially suited for private use, or charter service at public parks, pleasure resorts and Summer hotels.

A NOVEL HIGH-TENSION SERIES ENCLOSED ARC SYSTEM.

BY J. H. HALLBERG, E. E.

Many articles have appeared in the pages of this journal describing the enclosed arc lamps and calling attention to their many advantages, but the writer has not seen any particular attention called to the high-tension series enclosed arc lamps, which have now been perfected and are manufactured by a few firms. Probably the reason of this silence is that the manufacturers have not met with such success in designing and operating lamps on this circuit as would warrant this recommendation for street and commercial lighting.

I will first take up a few questions as to the requirements of the enclosed arc lamp for high-tension series, street lighting and commercial circuits. The insulation should consist of mica, lava and porcelain; fiber should never be used in arc lamps, except for switch handles. When testing insulation, it is best that you should not depend on the ringing of a magneto bell, but should take one wire from the magneto in operation and connect to the ground or to frame of dynamo or cover of lamp; then the other wire should be attached to a small handle and taken in one hand, while with the other hand you touch some connection or bare wire in sure contact with circuit; to be perfectly sure, wet your hands. It is understood that you must be insulated from the ground. I have found this method to be the surest where no special testing apparatus is at hand, as you will surely feel the current from the magneto if there is a leak. Never depend on ordinary insulation in high-tension series lighting, as the extremely high pressure of the "kicks," caused by flashing of the dynamo or the breaking of a wire, will break through any ordinary insulation, consequently, ground lamps and apparatus. The lamp should be provided with a standard hanger and so designed that it will fit in the majority of hoods with hanger-boards now in use. The lamp should be provided with a cover that is easily removed for inspection. The lamp should be snow, rain and as nearly dustproof as possible, and at the same time ventilated.

All parts should be easily interchangeable with the use of no other tools than a pair of pliers and a screwdriver. My experience has been that it is better to use binding posts and connectors than solder, for various reasons, the main one being a coil can be changed without the troublesome use of a soldering-iron. The cut-out should be positive in its action and have a sure adjustment, and its contact points should be easily interchangeable. It is preferable that the clutch works direct on the carbon, as the wear of the clutch is thus reduced on account of the softness of the carbon. The lamp should be equipped with some device to prevent the slipping of the carbons. In a differential lamp the slipping could only happen during its burning, as the carbons are together during the day or when the lamp is not working. In a shunt-wound lamp the device should always be in action, as the carbons in a shunt lamp are always apart except at the moment that the arc is struck. This device may seem unnecessary, but experience has proven that the best of clutches will slip in stormy weather, especially on lamps placed on tall poles, or if they are suspended from poles which also carry one or more trolley wires.

The inner globe should be easily interchangeable, as when trimming a number of lamps it is demonstrated that it is best to exchange the dirty inner globes for clean ones, and bring the dirty globes and what is left of the upper carbon back to the station, where the former are cleaned and the carbons are cut to the right sizes for negative or lower carbons for the next trimming. The lamp could be so designed that it would maintain the same voltage at the terminals and arc, whether the amperes may be four or seven, varying, or any constant between these two numbers. A lamp designed for four amperes should operate on any amperage between four and seven. The arc in the lamp should consume the entire voltage as measured at hangers except one volt. This one volt is all that is necessary to hold cut-out open. When lamp is cut out by its automatic cut-out, not over four volts should be expended when lamp coils are hot. The shunt coil and cut-out should not consume over one-tenth ampere when lamp is hot. If possible, the lamp should be so designed that no dash-pot or springs are required in its mechanism. This is very important, as all of our readers have probably experienced more or less trouble from dirty dash-pots, feed and cut-out springs. In many cases these lose their tension, which would either keep the lamp out entirely or destroy all adjustment, allowing the lamps to burn 30 to 70 volts instead of 45 to 50. The writer knows of some cut-outs that would not shunt the lamp until the arc reached about 140 volts. This, of course, would burn the shunt coils in the lamp, as they were only designed to stand a maximum of 70 volts. I believe all of you will agree with me that a spring and a dash-pot are the most frequent causes of trouble on a high-tension street lamp which is subjected to internal heat and to dust and dampness. The lamp should be of light weight, say 25 pounds, complete with hood, hanger-board and globe, so as to allow the use of lighter construction and suspensions. A light lamp will also make the old balancing weights unnecessary, and on shipments of lamps the freight is about one-half of that paid for old-type long and heavy lamps. The lamps should be adapted for either inside or outside service without change; at the same time they should be so designed that if necessary the plain cover can be substituted for a fancy one without any changes on the lamp. The lamp should be as short as possible—say about 34 inches from top of hanger to bottom of globe—so as to allow the lamp to be used in low-studded buildings, basements and hallways. If it should be necessary to have a long lamp in order to suit some particular customer, it can be done by simply putting on a longer cover without changing the mechanism or the globes. The lamp should regulate so that its voltage would not vary over five volts at any time from normal. The lamp that is designed and built so as to come up to the above specifications should certainly meet with the approval of most station managers and electrical engineers. Since the invention and perfection of the enclosed arc lamp it is possible to build a lamp of the type above mentioned, and the writer, after personally handling nearly 100 of them for street lighting purposes during the past 10 months, has come to the conclusion that it is the most convenient street lamp, and will surely occupy a prominent position among the enclosed arc lamps, as it possesses higher efficiency than any other type of enclosed arc lamp as yet advertised in this country.

The light from the high-tension enclosed series arc lamp possesses all the advantages that are so noticeable in the low-tension direct-current enclosed lamp, which are a perfectly steady light, perfect diffusion and distribution, the tint of which can be governed by the use of different combinations of globes. It burns from 100 to 150 hours, with one 12 by ½ solid "imported" carbon. This not only saves labor in trimming and attention, but the lamp mechanism and clutch does not wear, as the lamp feeds only a few times every 12 hours. It must also be remembered that the clutch works on the soft carbon, which prevents it from wearing, and, as there are no carbon rods, the repairs on an enclosed arc lamp are only about 10 per cent of that for the open arc system. If we now get a lamp as per above suggestion, it would be perfectly proper to ask the following question, if you do not already realize the economy of a plant equipped with this type of lamp for street lighting: How do these lamps compare with the open arc system in regard to amperes, voltage and candle-power? The old-type open arc lamp requires 10 amperes and 45 to 50 volts (equal to 320 watts) to produce what is known as 2,000 nominal candle-power. The new enclosed arc lamp with clear globes requires seven amperes and about 71½ volts (equal to 360 watts) to produce 2,000 nominal candle-power. From the above figures you can see that the wattage remains the same for both types of lamps, consequently your coal bill is not increased when you use the enclosed series lamps. The enclosed arc lamps require about 300 higher voltage, but the amperage may be reduced accordingly. I consider this a great advantage, especially if your circuits are very long, as the line loss would be cut down considerably. If you desire a 1,200-candle-power system your wattage consumption would be about 300 to 325 (equal to four amperes and 80 volts, or five amperes and from 68 to 70 volts). I mentioned in the early part of the article that a shunt-wound high-tension enclosed arc lamp could be so designed that it would operate with the same arc voltage, even though the amperage varies about 40 per cent. You will undoubtedly see the advantage of this. To-day you will find that almost any manufacturer of arc dynamos will furnish regulators and controllers, by the adjustment of which you may change the amperage from, say, four and one-half to five and one-half amperes, and the dynamos will hold their amperes very steadily at any point. This enables you to get a perfectly controllable arc circuit, which may be varied at will from the station.

On dark nights you may run your dynamo at seven amperes. The next night may be moonlight, then you can cut your dynamo down to, say, five or six amperes; then, during Winter, when snow is on the ground, you will not need over, say, five and one-half amperes during the darkest nights. On moonlight nights, with snow on the ground, you could probably go as low as four and one-half amperes on your circuit, and still you would light your streets equally as well as you would on a very dark night with seven amperes. This feature of this system will save a station or a town a good many dollars. Figures show the following:

Two hundred lamps at 70 volts each equal 14,000 volts by seven amperes equal 98,000 watts.

Two hundred lamps at 70 volts each equal 14,000 volts by four and one-half amperes equal 63,000 watts.

This shows a saving of 35,000 watts per hour. If your plant can produce one electrical horse-power per hour with four pounds of coal, you would save during an 11-hour run on four and one-half amperes instead of seven amperes about one ton of coal, equal to, say, about $2. By applying this system, I am sure a great many plants which now shut down at 12 midnight could persuade the town which they light to pay a little more and run on a very low amperage the rest of the night, and then it might be profitable to run an all-night incandescent circuit. I am sure lighting plants in small towns could get many new customers on their incandescent circuit if they could afford to run until daylight instead of shutting down at 12 midnight. These are only a few examples showing the many advantages that can be gained through the use of this system.

There are many stations which have four to seven-ampere dynamos that are not in use, for, as the town grows, the requirements change, a larger light is wanted, and a 10-ampere arc system has to be put in. Now, clean and fix up your old four to seven-ampere dynamos, write for prices and information to arc lamp manufacturers who make a high-tension series enclosed arc lamp. Be sure that the manufacturers guarantee the lamp to burn on a varying amperage of, say, about three without change in the voltage at hangers, as your old-type dynamo may not regulate as well as the later designed and improved lamps. So you see if the town board should vote to put in 15 or 20 new 2,000-candle-power arc lamps, and your present 10-ampere dynamos are loaded, you can, if you have an old six and one-half-ampere dynamo, by simply buying this type of lamp and putting up new circuit, furnish this town with this lamp and save the cost of a new dynamo. The foregoing explanations and suggestions might alone show station managers how they would profit by the use of an arc lamp of this type, but I will now call your attention to the most important fact, and that is, that this lamp operates for 125 hours without any attention or trimming. At each trimming there is only used one 12 by ½ "solid imported" carbon. The cost of this quality of carbon is between $27 and $30 per thousand; consequently, a lamp of this kind, if operated 10 hours every night in the year, will consume 30 of these carbons per year, equal at highest carbon price to 90 cents. If your carbons for the old-type open arc lamp cost you $15 per thousand pair delivered (this is certainly the lowest cost figure), then a lamp of that type which consumes one pair of carbons each night of 10 hours requires 365 pair for one year, equal to $5.47½, and making a saving of $4.57½ each year per lamps in carbons alone.

As the enclosed arc only needs trimming once every 10 or 15 days, one or more trimmers may be dispensed with. The enclosed arc having an inner globe, a deduction of about $1 per year for each lamp might be made from the above figures to allow for the additional chances of breakage.

Electrical Apparatus Wanted in Russia.

It is reported that the municipal authorities at Warsaw, Russia, are inviting proposals for supplying the town with electrical power for purposes of lighting, tramways, etc. Applications should be addressed to the president of the town of Warsaw, from whom particulars can be obtained. As the proposals will not be considered until some time in August next, there is ample time for the American manufacturers and contractors to submit their prices after the rules, regulations and conditions have been sent to them.

METHOD OF HANDLING METERS.

HOW THE METER DEPARTMENT OF A BIG CENTRAL STATION IS MANAGED.

(Concluded from page 165.)

On the 23d or 24th of each month the entire meter force, five men, start out to read meters, and at the end of four days all of the 2,200 readings have been made with the exception of a very few "stragglers." In the meantime the first day's cards are brought in, the reading marked on them by the meter superintendent, for the men do not actually read the meters, as will be explained later, and then the cards are turned over to the office force, who, in turn, make out the bills and arrange them for delivery on the last day of each month.

Each customer has a folio number in the ledger, his meter card has the same number, as also has his lamp exchange card and the folio in the lamp exchange ledger. The card system is used throughout.

A small card, four and a half inches by four inches, made of flexible manilla cardboard, is used for meter readings. On this a facsimile of the meter dials is printed on both the obverse and reverse sides, the card having provision for six readings on each side, one card lasting a year.

On this card the monthly readings are marked by the meter men, not in figures, but a mere copy of the position of the hands on the dial, and when brought into the superintendent, the reading is marked in figures by him on the right hand side of the card. Cards are gone over a second time to insure correctness and to bring to a minimum the possibility of an error. The cards are then arranged in numerical order and sent to the office, where two clerks handle them, one entering the reading on the books and making out the bills, which have been previously made out as far as possible, and are in numerical order, and the other subtracting the previous reading from the present reading, and getting the difference, referring to a rate book, which gives the gross bill, net bill and discount at a glance; thus 376,500 watt hours, at 15 cents per 1,000, is 56.48 gross, 50.84 net, and 5.64 discount. A discount of 10 per cent is given on all bills paid on or before the 10th day of each month.

In the case of meter bills, the rate for which is 13½ cents per 1,000 watt-hours, the company has a sliding scale of discount, ranging from 10 per cent to 40 per cent, according to the size of the bill. These sliding scale rates are also given in the rate book, and the net bill and discount can also be seen at a glance.

The arranging and delivery of bills under this card system is accomplished by all the available men from the meter department and office for one forenoon. The routes are arranged geographically, there being a route card for each customer, and when this route is once arranged is never changed, additions being put in where they belong, and "cut-offs" taken out. One man calls off the folio number from the card route, and the bills having been divided into three piles, from 1 to 700, from 800 to 1,500, and from 1,500 to 2,200, they are taken out by the clerks, three in number, one for each pile, and are placed one upon the other in a common center, thus forming the route for delivery, and this route is divided into as many sub-routes as are men available on the morning of delivery.

There is also a card for the reading of meters, when a special reading is requested, or there is some doubt as to the correctness of the original or first reading, the second one being made by an expert, and this card, having the same folio number of the customer desiring a re-reading, before being sent out is compared with the original reading.

It has been found absolutely necessary to have an inspection made of the meters installed continuously, and this work is performed by two men. These men more than earn their salaries by the reporting only of meters stopped, and meters with blackened commutators. They are constantly on the go, having a certain number of meters to inspect daily and their reports are made daily upon slips for that purpose.

This prevents in a degree losses by stopping of meters, which is very considerable. For instance, a customer's meter may have been just inspected or read and found running, but owing to some jarring, or something falling upon the meter, it has become unadjusted and will stop. The condition of this meter would not be found out before the next regular reading if it was not inspected. Again, where a meter for a large installation of lamps, such as at private residences is installed many times, but a few number of lamps are burned, and a large meter that will not record on, say, six lamps means a considerable loss to the company. To overcome this the large installation of lamps at a private residence, which calls for a large meter, is first examined by an expert, and a meter of much smaller capacity, one that will record on one or two lamps, is installed, and to protect the meter from burning out, fuses of proper capacity are placed on the outside wires. This insures the safety of the meter, and when the fuses are blown a man is immediately sent up to replace them, or install a larger meter if the case demands it.

A record of card each meter is kept, on which the meter number, date received, when installed, when repaired, and how and where again installed, etc., is marked, so that a complete history of any one of the company's meters can be had at any time.

Recently there has been established at the central station in question a system of multimeter measurement under the Oxley system, whereby a consumer is given a rate two-thirds less for the consumption of current during 18 hours out of every 24. For this purpose two meters are installed in connection with the Oxley switch. These meters are operated and controlled from the central station, and the switch is used on the feeder pressure wires already installed, thus avoiding the expense of laying additional cables. This system is only installed for large consumers, a minimum charge being made on the "day" meter which prohibits the small, and, in all probability, unprofitable, consumer from using it.

The day rate or low rate meter is in operation from 12 o'clock midnight until 6 o'clock P. M. the following day, 18 hours, and for the other six hours, from 6 o'clock P. M. until 12 o'clock midnight, the night meter is recording.

The Oxley switch is placed in the wall between the two meters, and by an indicating hand which points either to the word "day" or "night," as may be the time of operation, indicates to the consumer which meter is recording.

While this system is entirely new, it is hoped the day load will be greatly increased, and the inauguration of new business for the company from the larger stores, and the introduction of incandescent arc lighting in places where the regular night rate would have made it prohibitive.

GEORGE H. DRAPER.

Telegraph Tournament at the Electrical Exhibition.

Mr. Fred Catlin, the manager of the telegraphic tournament, to be held at the Electrical Exhibition in New York city in May, has completed the preliminary arrangements for that contest, and has arranged the classes. Circulars on the subject will be ready this week for general distribution, and there is already a great demand for information on the subject from all parts of the country. Mr. Catlin informs the exhibition management that the entries will probably be more numerous than at any other tournament that has occurred, and thinks that some of the records will be phenomenal. It is proposed, in addition to the regular contest, to have interesting exhibits of telegraphic skill in novel directions. Mr. Jesse H. Bunnell, the electrical manufacturer and veteran operator, is taking a deep interest in the contest, and has volunteered to equip the whole stage with the necessary apparatus for the competition in the shape of keys, sounders, batteries and auxiliary appliances. Mr. Bunnell is desirous to have a separate prize offered for an "old-timer's class," and has already entered himself for that contest. He has a reputation, dating from the war, of being an unusually fast and skilful operator.

TOLD IN THE DYNAMO-ROOM.

He looked more like one of those peripatetic vendors of notions and small drygoods that can be seen in almost every community, especially in the Summer time, than a dynamo man, as he somewhat timidly stuck his head through the door of the Centerville station and inquired of Benson, the engineer, if "this was the electric lighting plant." Benson had come to work an hour or two before his usual time, because Bert had left two days ago on rather short notice, to take a position in the shops of an electrical manufacturing concern at Clearwater, some 120 miles away, where he thought his inventive faculties would have a wider scope. Pending the filling of the vacancy caused by Bert's resignation, his duties had been assigned to Benson and Jim, the two taking turns in doing the extra work.

Benson looked at the visitor and, critically surveying the odd figure, his features broadened into a genial smile, as he answered:

"Well, does it look to you like a sausage factory, my friend?"

"Oh, no, of course not; excuse me, sir," replied the stranger, as he carefully set down a voluminous satchel, deposited an opulent-looking canvas telescope bag near it and took from under his arm a good-sized bundle, wrapped with many turns of lamp cord. "I have a note to a Mr. Benson; possibly you can tell me where to find that gentleman."

"You have the pleasure of addressing him," said the engineer, reaching for the letter his visitor had meantime produced from the depths of some inside pocket. It was from Mr. Evans, and read as follows:

"MR. J. D. BENSON, Engineer.

"Dear Sir: The bearer, Mr. Edward Fairbairn, has been appointed dynamo-tender, *vice* Mr. Bert Ford, resigned. You will please instruct Mr. Fairbairn as to the details of his work and extend to him such courtesies as are in your power.

"Yours truly,

"C. C. EVANS, General Superintendent."

"How do you do, Mr. Fairbairn. I'm very glad to know you and pleased to find we have some one to take our former man's place. This double work was just about getting too much for him and me. I suppose you have had considerable experience with dynamos and electrical machinery in general?"

"Well, just a little, sir, just a little. You see, I worked four years in the Great Eastern Light and Power Company's plant at London, where I looked after 12 60-light arcs and four 3,000-light alternators, and for the past six years I held a similar position in the Western station at Chicago."

Benson looked a trifle surprised. Evidently the new man was not as green as he looked, and seemed to be very modest besides. "And how did you happen to secure this place?" he asked, inviting Mr. Fairbairn to take a seat and rest from his no doubt tiresome walk from uptown.

"Oh, I saw an advertisement of your company in the ELECTRICAL REVIEW and answered it. Mr. Evans told me he had 23 replies, and it seems I was one of the lucky ones he considered worthy of a trial."

"You were lucky, indeed, Mr. Fairfield ——"

"Fairbairn, sir, Fairbairn; but then you might just as well call me Ned."

"All right, Ned, and now suppose we start in and get ready for to-night's run; when Jim comes he can show you over to Dettmer's house, where you'll always find a clean room and plenty to eat. If it doesn't suit you, you can look for another at your convenience."

"All right, sir," replied Ned, unfastening the straps of the telescope and producing from its depths a pair of clean overalls, which he quickly put on. "I imagine the first thing to do is to smooth up these commutators—they feel a trifle rough," running his finger tentatively over the commutator bars of one of the arc machines.

"Yes, they do be a trifle uneven," replied Benson, "but we always had more or less trouble with those commutators, and it is only by a liberal use of that Cyclone compound that we can keep the sparking down at all."

"It feels to me as if this commutator is out of round," spoke Ned, after a careful examination; "besides, the way these brushes are set they act too much like scrapers on the segments; they should have at least twice as much bevel, so as to let the segments glide instead of scrape under them."

"Well, Ned, the machines are in your care," rejoined Benson, "so fix them up the way you think they should be."

"Ned smiled and asked for a mill file and some sandpaper, which were promptly produced by the engineer. Ned then asked him to start up the engine very slowly, so as to run the armatures about 200 revolutions a minute. This Benson did, while Ned carefully filed the commutator as round and smooth as possible, finishing with an application of sandpaper. The operation was repeated on the second machine, with the result that both commutators looked as smooth and polished as a mirror. Ned then took the brushes, and, clamping them between two pieces of wood in a vice, he filed them to a rather long bevel, having first trimmed them to approximately the right shape with a pair of shears.

"There" exclaimed Ned, as his job was finished, "I think we'll have no sparking to-night if we know it. The worst feature about this filing is that it causes a good deal of copper dust which is always apt to lodge between the terminals of the coils and other exposed places, and often causes a great deal of mischief. A friend of mine over in New Hampshire was always filing and sandpapering, until one day trouble began by the appearance of a so-called pinwheel; that is, a streak of sparks, inside of the armature. Do you know he took that armature out three times before he found the trouble?"

"I supppose he was not very careful in looking for the fault," ventured Benson.

"Oh, yes, he was careful enough. Each time he removed a quantity of fine copper dust that had collected among the wires and connections, and each time the armature ran nicely for a day or two, but finally he had to strip the tape off all the coil terminals before he found some more dust between two wires which were poorly insulated. A thorough cleaning and a couple of coats of shellac caused a complete cure, and he some time ago wrote me that he had no trouble since."

"That is a very probable occurrence," remarked Benson; "but how are you going to avoid trouble of this kind?"

"Why, the best way is to not make any dust," replied Ned, as he carefully cleaned away what filings had collected on the armature and fields. "Prevention is always better than a cure, and I find that by not allowing the brushes to cut, and by gradually securing a sort of glaze on the segments, you'll have little or no trouble from copper dust. I think you'll find that after to-night's run the commutators will have quite a polish, and by a little watching they can be kept so."

Ned's predictions proved true. On starting each machine he applied just a little of the compound, and while at first a few occasional sparks would appear, caused by small particles of copper, all sparking had disappeared after a few hours' run, and on shutting down in the morning the commutator looked so smooth and polished that Benson remarked encouragingly:

"Well, Ned, you're all right, and I hope you won't get the big head and leave, as Bert did, in case the boss gives you a raise."

During the evening Jim had, of course, made his appearance. Ned was duly introduced to him, and the two had immediately become good friends, when it was found that both were well acquainted with a mutual friend running a station in Chicago. Jim even went so far as to confide to Ned over a post-prandial smoke that, within the next month, he, Jim, would have occasion to look for a little cottage, not too far from the station, whereupon Ned enthusiastically extended his congratulations and generously offered him the free use for a term of five years, of his patent for a motocycle-perambulator.

Long Clothes and Submarine Telephony.

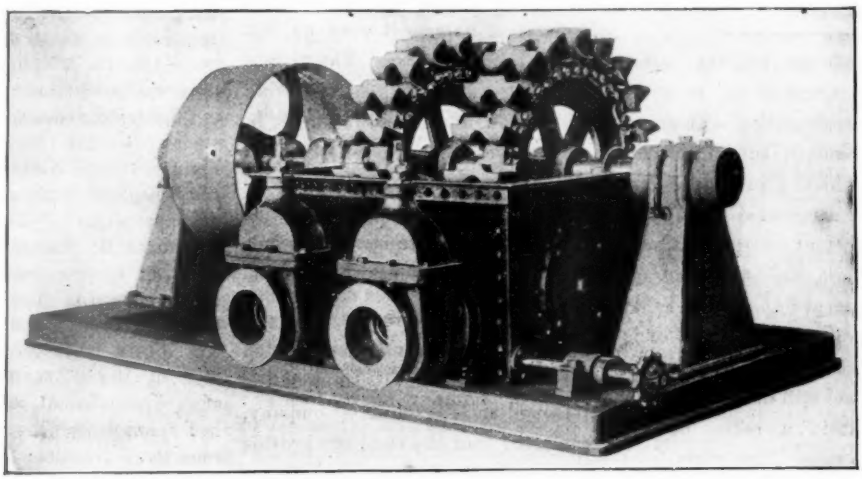
Our contemporary, the ELECTRICAL REVIEW, of New York—which, by the way, has just given up long clothes—announces the fact that the submarine boat the "Argonaut" has been connected to the Baltimore Telephone Exchange under the number 3,041. As the boat was at the bottom of the harbor we see nothing particularly novel in the fact. It is stated, however, that the wire on the boat is connected to a reel, so that it can be used at distances of several miles if necessary. We are surprised to see that our contemporary remarks on the fact that clear speech is possible under the conditions of trial.—*London Electrical Engineer.*

The National Park Bank, of New York.

There has been considerable activity and a sharp advance in the shares of the National Park Bank within a week, says the *Boston News Bureau.* Only two New York banks have held deposits exceeding $50,000,000, namely, the National City and the National Park. The business of the latter is increasing, and for the last few years has been especially profitable. The condition of the bank, February 18, showed a surplus fund of $2,500,000, undivided profits of $740,469 and deposits in excess of $55,000,000.

An Interesting Power Plant.

A striking example of the utilization of water-power, made possible by wheels of the Impulse type, is presented in the arrangements recently made for power in the textile goods factory of M. Benoist Cadet Fils, La Bastide, a town south of Bordeaux, France. Here a steam engine, which formerly was used to furnish the power for the entire factory, is now held in reserve for periods of low water, and the greater part of the time power is furnished by a 36-inch twin Impulse wheel, working under a head of 128 feet at 285 revolutions per minute, and developing 40 horsepower. The use of contracting nozzles makes a high efficiency possible with the varying loads.



An Interesting Power Plant—Impulse Water-Wheel in a French Textile Factory.

The illustration herewith presented shows the wheel sent to La Bastide by Messrs. Powell & Colne, export agents, Bowling Green Building, New York, which was furnished them by the American Impulse Wheel Company, of 120 Liberty street, New York.

The photograph was taken with the top casing removed, and the shape of the buckets peculiar to this wheel can be observed. The design has been carefully worked out, and in this wheel, as in all others made by the American Impulse Wheel Company, the mechanical perfection attained is in striking contrast to the faulty productions of many manufacturers.

The high efficiency of the wheels made by this company is due to the close attention and study which its engineers have given to every detail, and to the great care exercised in manufacturing. A prime mover with so low a first cost, and almost negligible expense for repair, and requiring little or no attention while running, is an attractive one to large numbers of manufacturers who are at present burdened with heavy expenses in connection with their motive power. The possibilities of the electrical transmission of energy are now so great that many concerns might, at comparatively small expense, utilize water-powers, even though they were located at considerable distance from their establishments. The numerous inquiries on such subject which the American Impulse Wheel Company receive have the careful consideration of their engineers, and as full information is sent in reply as the data presented will permit.

Establishing Communication between Fortifications.

Gen. A. W. Greely, chief signal officer of the army, spent several days last week in New York, Boston and other eastern cities on work connected with establishing communication between fortifications. In New York General Greely had a conference with Capt. James Allen, of the Signal Corps. Captain Allen, by order of General Merritt, recently laid out a plan for connecting all the fortifications in New York Harbor by telegraph. It includes the laying of a cable from Governor's Island to Sandy Hook, and connecting cables to Forts Hamilton and Wadsworth. Land wires are to connect Forts Schuyler and Slocum and Willett's Point with one another and with Governor's Island. The cost of this work has been estimated at $50,000. No money has been appropriated for the work, and if it is done at all it must be paid for out of the recently appropriated $50,000,000. General Greely went over the scheme with Captain Allen, and then the two visited Willett's Point.

ELECTRIC RAILWAY NOTES.

For the first 15 days of March the receipts of the Union Traction Company, of Philadelphia, increased over $2,500 a day.

The Newton, Mass., Street Railway Company has declared the regular quarterly dividend of two per cent, payable April 1, to stockholders of record March 19.

The Cincinnati, Ohio, Street Railway Company will issue $656,000 new stock, giving the stockholders the privilege of subscribing for the new issue at par. The allotment will be four per cent. The outstanding capital is $16,400,000 and the authorized capital is $18,000,000.

The equipment of the Illinois Central Railroad Company's suburban tracks with electricity has been abandoned for the present. This information is from reliable sources. The same authority says that the subject may be taken up at any time. The readers of the ELECTRICAL REVIEW will find full information in its columns whenever new developments occur.

Up to a comparatively short time ago, one of the greatest expense items connected with the operation of a lighting or street railway plant consisted of the repairs to armatures. In a station of considerable size, a force of repair men was usually kept, whose wages often amounted to considerable sums. The Miller-Knoblock Company, of South Bend, Ind., for some time past has been making and carrying in stock a complete line of armature coils for all standard motors. The coils are absolutely uniform and made with the greatest care. Any dynamo man of average intelligence can place them in position, and by their use the repair bills can be kept down to a minimum.

TELEPHONE NEWS AND COMMENT.

The Panhandle Railroad is putting in telephones to facilitate the movement of trains.

The new exchange of the New York Telephone Company at John and Gold streets, New York city, will be opened about May 1.

The local Bell telephone company is extending its lines into Bedford County from Johnstown and Huntingdon, and will establish exchanges at both Everett and Bedford, Bedford County, Pa.

The transfer books of the American Bell Telephone Company will be closed from April 1 to 14, both days inclusive, for the dividend declared last week, and for the annual meeting on March 29, from March 25 to 29, both days inclusive.

W. H. Kelley, proprietor of the Opera House Drug Store at Newark, N. Y., expects to install a telephone exchange at that place. It is stated that over 40 subscribers have been secured, and that the central exchange will occupy the ground floor of the Horton Block, which is to be erected this Spring on Union street.

The City and Suburban Telegraph Association, of Cincinnati, Ohio, has issued the local Bell telephone directory, No. 31, bearing date of March, 1898. As usual, this directory bears evidence of careful and intelligent work in its compilation, and, as the ELECTRICAL REVIEW has already remarked, it is one of the most convenient to use that is received at this office.

The American Bell Telephone Company, on March 16, declared its regular dividend of three dollars per share, payable April 15. The company does not declare extra dividends in March. It is reported that the directors will not ask the stockholders at the annual meeting on March 29 to authorize an issue of new stock; the company still has in its treasury money remaining from the last stock sale, and has in addition 1,500 share of stock, which will be sold at auction when money is needed by the company for further extensions. No action was taken at the meeting on March 16 looking to the disposition of these 1,500 shares of stock.

Electrical Review

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New Jersey electric station managers are warned to be on their guard against one John Shanaphy, who seems to have a faculty for getting away with big and unwieldy property. Last year he served a term in jail for stealing a 200-pound anchor. The other day at New Brunswick he stole a locomotive and ran away with it, only abandoning it when his capture was imminent. There is no telling, unless Shanaphy is permanently confined, when he may take a fancy to a 500-horse-power dynamo or engine, or both, and get away with the apparatus.

Prince Poniatowski is interested in an electric power transmission scheme in California which involves some startling ideas. The scheme contemplates the transmission of current more than 100 miles at 30,000 volts to the city of San Francisco. The transmission circuit will approach the city on a line of towers 200 feet high, set in the bottom of San Francisco Bay. If this proposition has been correctly reported, it might be as well for the Prince to employ a first-class engineer before beginning to build his towers.

Engineer officers of the army and torpedo experts of the navy are said to be experimenting with a new form of automobile submarine torpedo, from which great things are expected. It is operated by an electric motor, current for which is supplied from shore through wires trailing after the torpedo. It is said that the torpedo head is formed of a magnet, which will be attracted to the iron or steel hull of a man-of-war anywhere within a radius of 300 yards of the ship. The wires from the land regulate the movements and speed of the torpedo, and enable it to be brought back to shore if an attack is unsuccessful. If the experiments now making prove to be successful, this new torpedo promises to be a deadly engine of war.

In case war is declared by the United States on Spain, it is probable that the electrical fraternity will play a very important part in whatever actions may ensue. The setting and operation of submarine and subterranean mines involve considerable technical and engineering skill and a knowledge of electrical engineering. The American Institute of Electrical Engineers numbers among its membership many expert electricians who would undoubtedly volunteer their services to the government for such work. A number of electricians have already enlisted as privates in the two new artillery regiments recently created, and it is undoubtedly a fact that when the real need of the services of trained electricians is made apparent, it will be at once met by volunteers.

A bill has been introduced at Albany, N. Y., to create the Buffalo Board of Electrical Commissioners to examine and license wiremen. Can't the electrical companies be trusted to see to it that they secure competent employés?

If newspaper reports are true, a Paris physician has made a discovery that will be of undoubted value to electrical men who are so unfortunate as to be burned by the electric current. The Paris doctor says that a solution of one part picric acid and 75 parts of water will cure quickly the most serious burns. The pain is instantly removed without blistering or irritation, and the wound heals in four or five days. A yellow tint is left on the skin, which may be removed by a solution of boric acid. It will be interesting to learn the result of practical experiments with this discovery.

A New York woman has written to President H. H. Vreeland, of the Metropolitan Traction Company, requesting that the company provide smoking-cars for women, so that they may enjoy cigarettes, pipes and cigars in comfort and seclusion while traveling around and through the bargain belt of New York city. The woman who makes the request does so on the ground that women of the highest birth and breeding in other countries have been accustomed to smoke for centuries, not only in private, but in public as well, and that our distinguished grandmothers were smokers a hundred years ago. "We are not, therefore," says the correspondent, "going astray, but returning to an established custom." The improbability of the request being granted is as great as its novelty and its unusual source.

London cable dispatches state that the syndicate which has been booming the Marconi system of wireless telegraphy for the past year has concluded that there is no money in the scheme commercially. At the same time it is announced that Prof. Oliver Lodge has invented a new method of telegraphy without wires, by which messages may be sent over long distances. While there is no doubt that wireless telegraphy will be a great step in advance as a means of communication, and will most probably be a commercial success some day, the fact remains that the business and social world is so well served telephonically and telegraphically that a wireless system of communication will have to possess overwhelming advantages electrically and practically before its commercial success and general adoption can be assured.

Last week an evening paper in New York city printed nearly a column of "stuff" to show that it is impossible to construct a successful trans-Atlantic telephone line. The story was based on some popular facts and figures courteously supplied to a reporter by Mr. F. A. Pickernell, engineer for the American Telephone and Telegraph Company. Then the reporter wrote: "Following a direction of Mr. Pickernell's, some interesting figures made by Thomas Edison, bearing on a trans-Atlantic telephone, were found." Of course. The meaty facts were found in the files of the ELECTRICAL REVIEW after a member of this paper's staff had spent an hour with the helpless reporter. Needless to remark, the story, although hoary with antiquity, would have possessed at least one degree more of interest had a proper credit been accorded for the information supplied. May be, too, Mr. Pickernell prefers to have his "directions" correctly recognized. *O mores, O reporters!*

THE VOLTAGE OF THE EDITOR OF "LIGHTNING."

TO THE EDITOR OF ELECTRICAL REVIEW:

Your editorial on "Another British Failure," in the REVIEW for March 16, reminds me of a similar failure to "catch on" to a passing joke, indicating a lack of appropriate brain area devoted to humor, or that it is in a state of physiological inhibition.

A year or two ago I attended a meeting of the electrical engineers in London, and was introduced among others to this same editor of *Lightning*, as the editor of *Lighting*. I playfully asked him what his voltage was, and he went on with seriousness to explain how it was known that lightning must be many millions of volts. My countenance fell and I saw he was a dielectric in my field.

Yours truly,

A. E. DOLBEAR.

Tufts College, Mass., March 17.

Wall Street and the Electrical Stock Market.

General conditions in the stock market have undergone no change since last week. The public persistently remains away from the securities markets as long as a war with Spain is among the possibilities. Technical conditions have governed the stock market this week. Professional traders "sold short" to a greater extent than they themselves realized. A very prominent and very shrewd speculator perceived the condition of affairs and bought stocks as they were offered. On Monday afternoon, in the parlance of Wall street, he began a movement by which he forced the shorts to "cover," with substantial appreciations in values. The market ruled steady during the middle of the week. Then the bears resumed their old tactics, found themselves again oversold, started once more to cover, and quotations advanced sharply. News of intrinsic interest, such as statements of earnings, etc., was disregarded, the attention of speculators being centered on developments in the Spanish situation.

General Electric was only fairly active, advancing from 30 on Monday to 32⅞ on the following day. During the rest of the week fluctuations were well within these figures. Only one sale of the debenture 5's was made at 101¼. It is understood that informal discussions are being indulged in by officials and directors of the company with a view to a re-arrangement of capital, settlement with preferred stockholders and resumption of dividends.

Western Union followed the course of the general market, fluctuating between 84¾ and 87¾. The collateral trust 5's sold at 109½. Some of the buying in the stock was for inside account. It is pointed out that if no war should take place the stock is cheap at the low figures, while if hostilities should actually break out the company ought to do a largely increased business, both the government and the newspaper press being large users of the telegraph in war time.

North American was very quiet throughout the week, selling at 5⅛ to 5⅝. The prospect of possible competition forced the Milwaukee Electric Street Railway Company to offer to reduce fares during rush hours and certain concessions to the city in return for an amended franchise. The Board of Aldermen has laid aside the proposition until next week. It is not concealed that the prospects of rivalry by a new company have caused considerable uneasiness to officers of the Milwaukee company.

There were no sales of Edison Electric of New York stock during the week. The bonds were quiet, the first 5's selling at 109½ and the consolidated 5's at 115.

American Telegraph and Cable was inactive, only a small sale of stock taking place at 89, and the four per cent bonds changing hands at 104.

The annual report of the Electric Storage Battery Company for the year ended December 31 last shows that while receipts increased $312,715 over 1896, expenses were greater by only $129,423, leaving a profit of $183,292. Other income increased, and the interest on bonds likewise showed a gain, the balance, however, showing an increase of $186,747 over the previous year. The sales nearly doubled and the company has a net surplus of $257,944.

The regular quarterly dividend of $3 per share, payable April 15, was declared on American Bell Telephone stock. At the annual meeting to be held the 29th, no action will be taken by directors to authorize an issue of new stock. A special meeting will be held before the annual meeting to consider the annual report. At the directors' meeting for the declaration of the dividend, no action was taken looking to the disposition of the 1,500 shares of stock in the treasury. The stock gained 10½ points from the opening on Monday of 248½, but subsequently lost part of the gain, closing at 244. Other stocks on the Boston Exchange were traded in to a nominal extent, Erie Telephone gaining one point to 66, later losing all the decline and closing at 64¾. General Electric preferred was quiet, selling at 90, closing at 85 offered, 89 asked. New England Telephone gained a point to 122, declined subsequently and closed at 120. The stock was bid 121, offered at 125.

On the Philadelphia Exchange, stocks were quiet and steady, Electric Storage Battery common being quoted at 20 to 21, and the preferred 23 to 23⅛. Pennsylvania Heat, Light and Power recorded a sale of 100 shares at 21½.

RAY.

Wall Street, March 19.

Northwestern Electrical Association.

At a meeting held at Janesville, Wis., March 14, of the committee having in charge the Summer meeting of the Northwestern Electrical Association—present, Chairman Norcross and Messrs. Korst, Doherty and Hill—the following resolution was put to a vote and unanimously carried:

Resolved, That as a committee of the Northwestern Electrical Association, we accept the invitation of the cities of Duluth and Superior to visit those cities next June.

That Mr. J. M. Hill, of Chicago, is authorized by this committee to make arrangements with any steamboat company for a Summer meeting of said association, to be held en route from Chicago, via Sault Ste. Marie, Hancock and Houghton, to Duluth.

PERSONAL.

Mr. Georges Pelissier, editor of *Eclairage Electrique*, Paris, was a New York visitor last week en route to New Zealand.

Mr. Wm. B. Wreaks, of the Westinghouse Electric and Manufacturing Company's New York staff, left last week on a three months' trip to Mexico.

Mr. F. A. Gilbert, president of the Boston Electric Light Company, sails to-day on the "Majestic" for Europe, where he will enjoy a month's vacation.

Mr. L. E. Frorup, general sales agent for Schiff, Jordan & Company, New York, importers of the "Ship" carbons, has left for an extended western trip.

Professor Massashi Namba, professor of electrical engineering at the University of Kioto, Japan, is visiting the United States inspecting electrical work.

Mr. John H. Reid, of the Westinghouse Glass Works, Pittsburgh, is in the metropolis on business for his house. The demand for arc light globes he reports particularly heavy.

Mr. E. T. Gilliland, the well known electrical inventor, has been elected president of the village of Pelham Manor, N. Y., where he has made his home for several years past. This is an honor worthily bestowed.

Mr. Samuel L. Nicholson, who has been identified with the C & C Electric Company, of New York, for some time, has recently joined the staff of the Westinghouse Electric and Manufacturing Company at Pittsburgh.

Mr. W. D. Packard, secretary and treasurer of the New York & Ohio Company, of Warren, Ohio, manufacturers of Packard lamps and transformers, visited New York city last week and made a welcome call at the ELECTRICAL REVIEW office.

Henry E. Hawley, general manager of the Hudson River Telephone Company, Albany, N. Y., and Henry L. Storke, president and general manager of the Empire State Telephone Company, were visitors in the metropolis last week conferring with telephone magnates.

SOME POINTS ON THE TELEPHONE SITUATION.

THE BERLINER PATENT CASES NOT TO BE TRIED FOR SEVERAL MONTHS.

In response to a number of inquiries the ELECTRICAL REVIEW gives the following information concerning the status of patent suits between the American Bell Telephone Company and some of the independent companies. It seems that none of the test suits for infringement of the Berliner patent have been as yet brought before the courts for final settlement by the American Bell Telephone Company. The court proceedings have so far consisted in the filing of bills and the hearing of testimony in support of them.

After the United States Supreme Court sustained the validity of issue of the Berliner patent in May, 1897, the American Bell Telephone Company, through its counsel, Mr. F. P. Fish, brought two suits for infringement in Massachusetts, one being against the National Telephone Manufacturing Company, and the other the Century Telephone Company. The hearings in these cases were delayed chiefly on account of the illness of Mr. Fish. Recently it is understood Mr. Fish made a request to have the cases tried, but the defendants secured a stay of proceedings, and it will probably be some months before these trials are heard.

Meanwhile no action has been taken against the independent telephone companies, who have increased rapidly in number and extent, except those against the two referred to above. It is reported that when these two cases are decided the American Bell company will proceed against other independent companies which are claimed to be infringers, provided the decisions of the court are in favor of the Bell company. It is then probable that a sharp contest will occur in the courts, as it is believed that several of the large independent western companies will support their eastern competitors in any proceedings which may be brought against them by the American Bell Telephone Company.

American Institute of Electrical Engineers.

The 123d meeting of the institute will be held at 12 West Thirty-first street, New York city, on Wednesday, March 23, 1898, at 8 o'clock P. M. A paper will be presented by Prof. Reginald A. Fessenden, of Allegheny, Pa., on "Insulation and Conduction."

INSULATORS FOR LONG-DISTANCE TRANSMISSION.

AN INTERESTING DISSERTATION ON AN IMPORTANT SUBJECT.

TO THE EDITOR OF ELECTRICAL REVIEW:

I have read the article in the November, 1897, number of the *Journal of Electricity*, entitled "Insulators for Transmission Lines," and the articles in the January number, entitled "A Multi-glaze Insulator" and "The Making of Porcelain Insulators." The articles are all of great interest to those who have had experience with the difficulties of insulation on long-distance transmission lines, but they are rather surprising in one respect, namely, that they all indicate a belief on the part of the writers that no "successful" insulator has yet been found and used in the Pacific Coast market. This is particularly so, as there has been no trouble with insulators on the part of the eastern companies at Niagara Falls, Chambly or Lachine, in all of which localities the climatic conditions are supposed to be much more severe than those existing on the Pacific Coast.

In the first-mentioned article I notice a statement that a glass insulator is better than a porcelain insulator, in that "it will not puncture." The experiments which have been made in testing glass and porcelain insulators at voltages of 40,000 and upward indicate that while it is not feasible to puncture a small glass insulator yet the reason for the failure to puncture it is not so much because of its "puncture resisting qualities" as it is because the glass avoids the puncture test by permitting and assisting the current to go around rather than through it. Porcelain, on the other hand, meets the test squarely, and is either punctured by the current or holds it surely, not allowing it to pass around the surface readily.

I notice the further statement of the superiority of glass, in that defects existing in it "are readily discernible with the eye." Experience again with high-voltage testing of both glass and porcelain indicates that tests with the eye are of value only as against mechanical defects, and that nothing less than a very high-voltage "break-down test" with salt water and a transformer of great strength and pressure will determine the electrical resistance of an insulator.

It is further stated that, "by the proper annealing of glass, the objection of extreme brittleness is removed." It is a well known fact that the additional strength which is imparted to glass by annealing lies in some peculiar manner on the surface only, and that it pertains exclusively to the object so annealed as a whole and not to its individual molecules. In other words, annealing is what might be called a centripetal force or protection; and further, when any part of the object is broken this strength and protection departs at once from the remaining portions of the object. In the case of insulators, as is well known by telegraph linemen, a glass insulator when struck by shot or stone "flies" and allows the conductor to fall to the cross-arm. The experience of the same men with porcelain insulators is that, in the first place, shot will not break a porcelain insulator; and further, that, when struck by a stone or heavy missile, only that part of the insulator which is in immediate contact is broken, and the remainder of it stays on the pin and holds up the conductor, showing that the strength of the porcelain is evenly distributed throughout its whole body.

It is also stated in the article in question that "the difference between the hygroscopic properties of porcelain and glass can not be measured, and there seems to be good ground for this assertion." It is not clear whether the writer means that the hygroscopic difference is so great or of such a nature that no means have been devised for measuring it, or whether, on the other hand, he intends to convey the impression that there is no hygroscopic difference. The fact of the case, however, is that the hygroscopic difference is very great and very material. Laboratory and working tests by electricians in the East have conclusively determined that there was such a difference, some of the tests being over parallel lines of glass and porcelain, approximately 100 miles long. The most conclusive and absolute proof, however, is the fact that porcelain insulators are in exclusive use in England and other foreign countries by reason of the failure of glass to satisfactorily insulate the lines in the almost continuously moist and foggy condition of the atmosphere.

The reasons which are given in favor of "a multi-glaze insulator" appear to indicate the cause of the trouble which transmission lines on the Pacific Coast have had with insulators. The assertion that "the puncture-resisting properties of a porcelain insulator for use on high-potential lines depends largely, if not entirely, upon the quality of the glaze with which it is covered and the thoroughness with which it is applied" is certainly based on a misapprehension. Tableware potters are well acquainted with the fact that glaze is absorbent to a certain degree, and that it is only a question of time and proper exposure when it will allow itself to be penetrated by acids, alkalies or moisture. So well recognized is this fact that the best class of tableware is made from a porcelain body which in itself, and without any reference to the glaze, is absolutely and entirely acid, alkali and moisture proof. In other words, the glaze is the weakest part of a good piece of table china.

In the "multi-glaze" insulator there are "six skins of glaze and two layers of glass." An experienced tableware manufacturer would at once say that there were four times as many chances of trouble with such an insulator as with one having only the inner and outer coat of glaze to protect it from dirt and to give it its hygroscopic qualities.

The claim that "should the outer shell absorb moisture the two layers of glass, together with the remaining five layers of glaze, will unfailingly prevent the passage of current * * * or moisture * * * beyond the outer shell" is a confession of the weakness of the glaze and that the manufacturers put no dependence on it. Insulators of this style have been tested at a high voltage and found to stand a good pressure, but after having their outer petticoats broken and being soaked in salt water they have failed utterly to withstand the same test; whereas one-piece insulators, made of a superior quality of porcelain, have undergone a parallel test at the same time and stood up just as well after the breakage and soaking as before. This fact is of great importance in view of the necessity of having insulators that can be depended on in long stretches of wet or foggy weather, and also to support the wire and insulate, even though damaged by stones thrown by small boys, or rifle balls shot by gunners.

In thus advocating and presenting the advantages of a porcelain insulator I fully agree with Dr. Perrine's statement that "only that amount of glass should be present which is necessary to fill up the porosity of the dehydrated silicate of alumina," for the introduction of any greater amount of glass than this will at once give to the porcelain that brittleness which is the characteristic and one of the chief disadvantages of glass.

The temptation to do this is very great. A reference again to the condition of the tableware trade will show that it is a very common thing for manufacturers of cheap goods to use the glassy pastes. The difference, however, is well recognized in the trade, and a broad distinction made in price between the true porcelain of Limoges and the glassy product of Carlsbad. The differences between the bodies can be detected practically by simple tests of shock, as well as by a visual comparison of the fractures of the two grades of ware.

I must take exception, however, to his statement that "it is at present unnecessary to attempt any re-designing of the insulators in use until we have thoroughly tested the capabilities of our porcelain manufacturers to produce insulators of the present form strong enough to carry the wire, and sufficiently solid to prevent the escape of electricity through the body of the porcelain without reference to the character or existence of the glazing."

All the insulators made of "Imperial Porcelain" are tested electrically before they are glazed, in order to determine the existence of any cracks or flaws in the body itself. They are then glazed and retested, in order to determine whether they have met with any accident in the subsequent handling or the second fire in the glost kiln. An insulator which passes these tests of from 25,000 to 100,000 volts, according to its size, can be depended on for service.

The cracking in the body of many of the insulators which have been on the market, and the porosity as well, have been due to the use of formulas which were not calculated to produce a satisfactory article, to carelessness in the process of manufacture, to difficulty of moulding, and to the inability of the moulded insulators to withstand, or the failure of the manufacturer to give them the proper heat.

In substantiation of my assertion that insulators have been made capable of doing the work, I quote the following from a letter of Mr. Paul M. Lincoln, electrical superintendent of the Niagara Falls Power Company, dated February 4, 1898, which was written soon after the recent heavy storm which so interrupted travel and electrical communication in the East:

"* * * * The recent severe storm has had no effect whatever upon our transmission lines. * * * * Since we have removed from our lines all insulators except the 'Imperial,' the insulator problem has given us practically no trouble whatever. Our second line, built last Fall, was equipped entirely with 'Imperial' insulators."

The lines in question are approximately 26 miles long, and are transmitting about 3,500 horse-power over

six 350,000 centimeter cables at about 11,000 volts.

The recent test for three days of the Pioneer Electric Power Company's lines, as described in the editorial columns of the November, 1897, *Journal of Electricity*, indicated that they had used an Imperial porcelain insulator, which fact has since been established by correspondence with Mr. F. O. Blackwell, who conducted the test.

Surely little more can be asked from the porcelain manufacturer who is able to supply insulators which will stand such tests as these. We must, therefore, look for further improvement in insulation to come from the adoption of improved mechanical and electrical forms. Many people are considering such matters very carefully, and the experience of the last two or three years with high-voltage transmission ought to afford a basis for determining what changes can be made to advantage. The principal trouble at present seems to be in connection with the pin, and I hope to see that weak feature eliminated from the best construction within a short time.

ALBERT T. BELL.

New York, March 12.

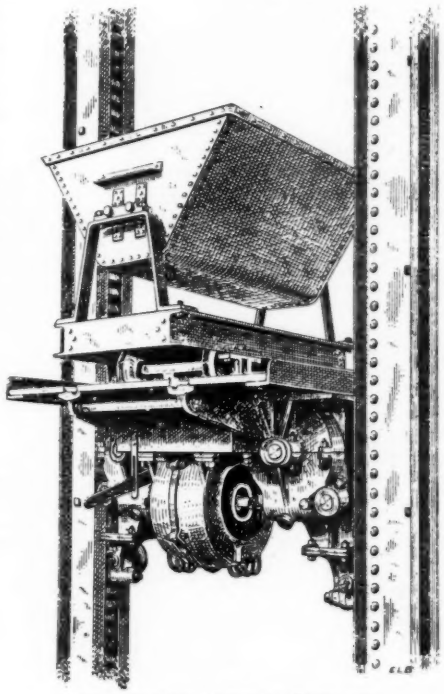
BOOK REVIEW.

"MUNICIPAL OWNERSHIP VERSUS PRIVATE CORPORATIONS, WITH LEGAL AND EDITORIAL OPINIONS, TABLES AND COST OF LIGHTS, AS FURNISHED BY PRIVATE COMPANIES AND MUNICIPAL PLANTS, WITH LIST OF MUNICIPAL PLANTS THAT HAVE BEEN SOLD OR ABANDONED. CONTAINING, ALSO, A COMPARISON OF ENGLISH AND AMERICAN GAS AND RAILWAY PLANTS." By M. J. Francisco, fifth edition, with statistics to date. Pamphlet form, 150 pages, price, 50 cents. Sent postage free, on receipt of price, by the Electrical Review Publishing Company, Times Building, New York.

This is the latest edition of Mr. Francisco's well known and authoritative compilation of information on the subject named. Mr. Francisco has been known for years as a pioneer in combating the municipal ownership of electric light and railway plants, and the facts and data accumulated in the study of his specialty have been of great value to all interested in electric lighting. In the present pamphlet the information is tabulated and arranged in a convenient manner, and, from the fact that it is thoroughly up to date, should be in the hands of any one who is called upon to meet the arguments of enthusiasts.

The Oerlikon Electric Elevator.

In the accompanying illustration is shown a type of electric elevator manufactured by the Maschinenfabrik Oerlikon Company. This system was first tried by them for a one-ton lift in 1894, and its success was such that the method has been constantly employed since. An electric motor is attached to the under-side of the cage, and drives a worm gear at each end of its shaft. There is a spur wheel attached to the shaft of the wheel of the worm gear on each side, and this gears into one or two pinions which work in the rack on the upright girders, the latter serving also as guides for the cage. Sometimes the connection between the motor and the spur wheel is effected through two worm gears instead of a single one.



THE OERLIKON ELECTRIC ELEVATOR.

The lifts are all worked with three-phase current, the motors having thus the same speed whatever the load. If the current is interrupted in any way, an electric brake comes automatically into action, and, to insure absolute certainty in working, the gear is duplicated and there are two pinions working in each rack in the latest pattern. When counterweights are used, at least two independent ones are employed, and the motor can furnish enough power to bear the lift even if one of the ropes break.

If silent running is essential, double-helical teeth are used for the rack and pinion, but in many cases a rack built up with studs, and a pinion with straight teeth is sufficient. The rack of the one-ton lift shown is built up in this way. It is claimed by the makers that not only are these lifts considerably cheaper to manufacture and erect than a pattern in which screwed spindles and nuts are used instead of racks and pinions, but that the working is more economical, as worm gearing of very high efficiency can now be produced. We are indebted to the London *Electrician* for the above data and the illustration.

Direct and Alternating-Current Fan Motors.

The fan motors of the General Electric Company for 1898 are built for both alternating and direct-current circuits. Some of the details are illustrated.

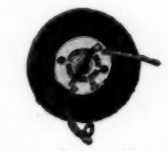


FIG. 1.—SPEED-REGULATING DEVICE GENERAL ELECTRIC ALTERNATING-CURRENT 1898 FAN MOTOR.

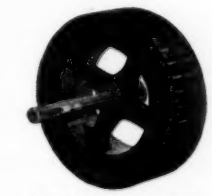


FIG. 3.—ARMATURE.

FIG. 4.—SELF-OILING BEARING.

In the alternating-current motor, to the cast-iron frame which supports a single long bearing are bolted the soft-iron laminations which make up the field core, provided with inwardly projecting teeth to form the poles on which are placed the field coils, wound with an ample quantity of wire and thoroughly insulated. The armature is built up, also, of soft iron laminations, assembled on a brass spider, but has no insulated wire. Bare copper rods run through the core and are riveted into disks at each side. Rotation being produced by inductive action, no commutator or brushes are required. An automatic oiling device gives perfect lubrication without oil throwing, and this, together with the long bearing, insures continuous cool operation. The alternating fan motor is built for 52 and 104 volts, 60 and 125 cycles, and is provided with a speed-regulating device, consisting of an inductive resistance cut in or out by a three-point switch. Movement of the switch over the first two points gives full speed and half speed, and on the third cuts the motor out of circuit. The motor may be, if desired, mounted on trunnions to allow of adjustment of the fan to blow in any direction.

FIG. 2.—FIELD CORE AND COILS.

The direct-current fan motor is as equally compact and carefully designed as that for alternating currents, and in appearance and general construction closely resembles it. As in the alternating motor, fan and armature revolve in a single, long, self-oiling bearing. The commutator is completely enclosed, and the carbon brushes incased in small tubes, readily unscrewed for inspection. A regulating switch provides for variation of speeds. These motors are finished in black enamel, the fan guard and trimmings in polished nickel.

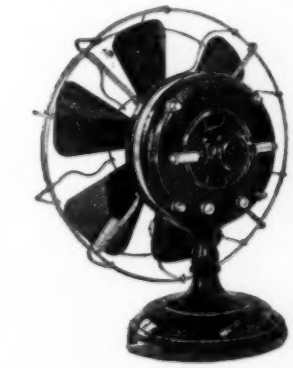


FIG. 5.—1898 DIRECT CURRENT FAN MOTOR.

The books of the West End Street Railway Company, of Boston, will be closed from March 18 to April 2 for the payment of the semi-annual dividend on its common stock.

ELECTRIC LIGHT FLASHES.

The Gloverdale, Cal., electric light plant has been destroyed by fire, at a loss of $10,000.

Hansville, Ky., will have an electric light plant, the contract for which has been awarded.

Somerset, Ky., under a 20 years' franchise, has awarded a contract for electric lighting to Beecher Smith, Jr.

The Lebanon, Ky., Light, Ice and Power Company will probably install a 1,300-light alternator during the coming Summer.

Campbellsville, Ky., wants an electric light plant at once. Nicholasville and Elizabethtown, Ky., are also negotiating for electric lights.

The earnings for February of the Edison Electric Illuminating Company of New York, including the high-tension systems, were as follows:

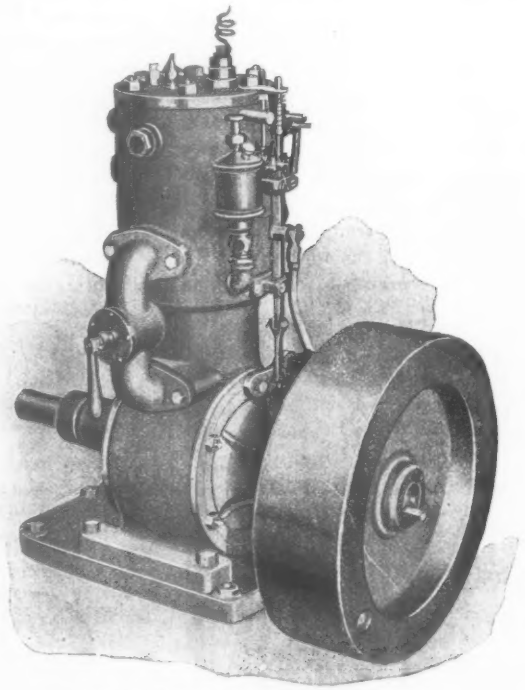
	1898.	1897.	Increase.
Gross	$256,880 87	$212,803 96	$44,076 91
Net	117,073 20	106,007 63	11,065 57
Gross, two m'ths.	$555,188 23	$453,103 01	$102,085 22
Net, two m'ths.	264,962 42	230,551 13	34,411 29

The Hayden Electric and Mining Company has been organized. The object is to establish a plant to supply electric light to the city of Cripple Creek, Colo., and to establish power plants; capital, $50,000; incorporators, M. A. Leddy, C. E. Tschuddi, E. P. Creighton, D. H. Rupp and C. W. Sells, all of Manitou.

Mr. Paul Doty, who has been general manager of the Consolidated Gas Company, which controls the entire lighting service of Long Branch, has been called to Grand Rapids, Mich., to accept the position of general manager of the Electric Lighting and Gas Company in that city. Mr. Doty has been succeeded by Mr. F. B. Wheeler, who has been with the company for the last two years.

The Palmer Gasoline Engine.

The steadily increasing popularity of gas engines for driving machinery of all kinds, and for the propulsion of boats, has led the Mianus Electric Company, Mianus, Ct., to place upon the market an engine of this class. This machine is said to be peculiarly fitted to supply the demand for an engine excelling in economy, safety and durability. The illustration shown herewith is of a two and one-half-horse-power Palmer marine gasoline engine, of the two-cycle compression type, with an impulse at each revolution of the crank.



PALMER'S MARINE TYPE GASOLINE ENGINE.

The Mianus company builds also gas and gasoline engines of the four-cycle type, having an impulse every other revolution of the crank. It manufactures engines from one to six horse-power, of both stationary and marine types, and can supply the castings and working drawings for the one-horse-power and two and one-half-horse-power engines to those who wish to construct their own engines. The engines made by this company are readily adapted to the driving of dynamos for electric lighting, motor-carriage work and the operating of printing-presses. They occupy but little space and consume a minimum quantity of gas or gasoline.

Western Electric Fan Motors.

The Western Electric Company is one of the first to open the electric fan campaign, and is fully prepared to meet the demands in the fan-motor line, which from present indications promise to far exceed last year's business.

Its complete line of 1898 desk, bracket and ceiling fan motors is made for 110, 220 and 550 volts, and they are so designed that on a 500-volt circuit three 110-volt motors or two 220-volt motors may be operated in series with perfect safety to the motors, and the 500-volt motor can be operated on a 600-volt circuit continuously without injury. All of these motors are wound for three speeds and are made with self-oiling and self-aligning bearings.

On the desk and bracket motors the switch is placed in the base of the motor, whereas in the ceiling fans it is placed in a neat switch-box on the under side of the motor casing. The desk and bracket motors are made in two sizes, the blades measuring 12 and 16 inches in diameter; they consist of four wings, it being claimed that a four-blade fan is much more efficient than one with six blades.

The current consumption of the 12-inch motors is said to be less than any 16-candle-power incandescent lamp on the market, while the current consumption of the 16-inch motors is but a trifle more than that required for the ordinary 16-candle-power lamp. The energy required by the 220 and 550-volt motors is practically the same as that required for the 110-volt motors. One very desirable feature is the facility with which the motors can be disconnected from the base and inserted in the bracket. The guard of the motor is made in a most durable manner and is firmly fastened to the motor, which prevents it from jarring. These motors are finished in polished brass, nickel plate or black enamel without additional charge.

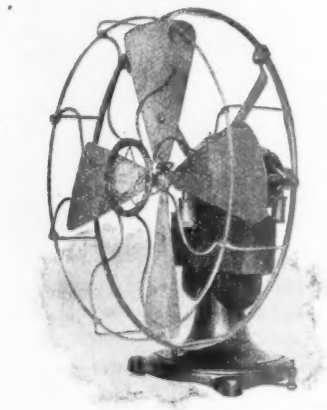


FIG. 1.—WESTERN ELECTRIC 12-INCH DESK FAN MOTOR.

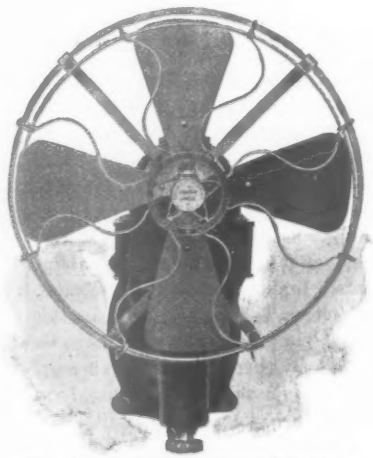


FIG. 2.—WESTERN ELECTRIC BRACKET FAN MOTOR.

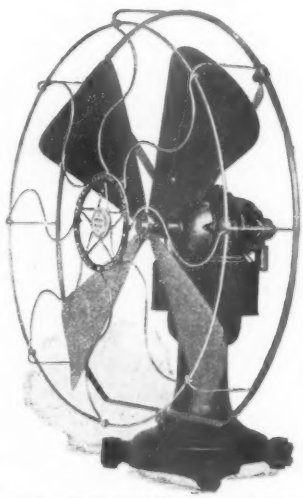


FIG. 3.—WESTERN ELECTRIC 16-INCH DESK FAN MOTOR.

Central Electric Station Burned.

The Central electric station at Palmer, Mass., burned on March 17; loss, $25,000. Superintendent E. H. Rollins and Electrician W. E. Shea were badly injured.

Electricity in the Russian Navy.

The Russian Admiralty has decided upon the installation of electric power in all warships for the purpose of raising ammunition, loading and working guns.

New Apparatus of the Western Telephone Construction Company.

It was not long after the independent telephone movement began to take anything like a firm footing that some of the foremost manufacturers realized the fact that a line of perfect apparatus would be absolutely necessary to compete successfully with the older existing companies. Ever since its advent in the field the Western Telephone Construction Company, of Chicago, has constantly improved and simplified its apparatus until to-day it stands high in points of efficiency, finish and durability. Some of its latest types of instruments show in a marked degree the progress made during the last few years, and a short description of some of its new apparatus is given herewith.

FIG. 1.—WESTERN TELEPHONE CONSTRUCTION COMPANY'S CABINET DESK SET.

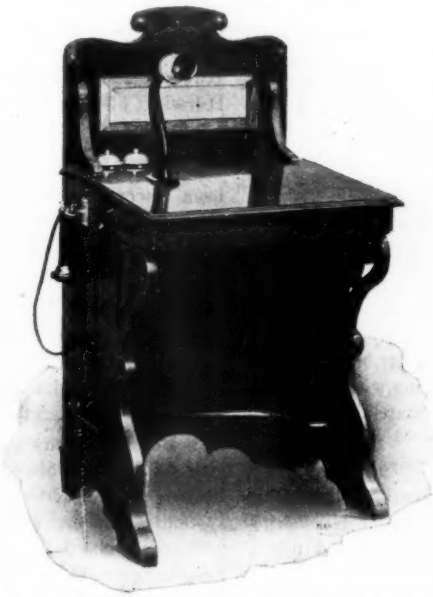


FIG. 2.—WESTERN TELEPHONE CONSTRUCTION COMPANY'S CABINET DESK SET.

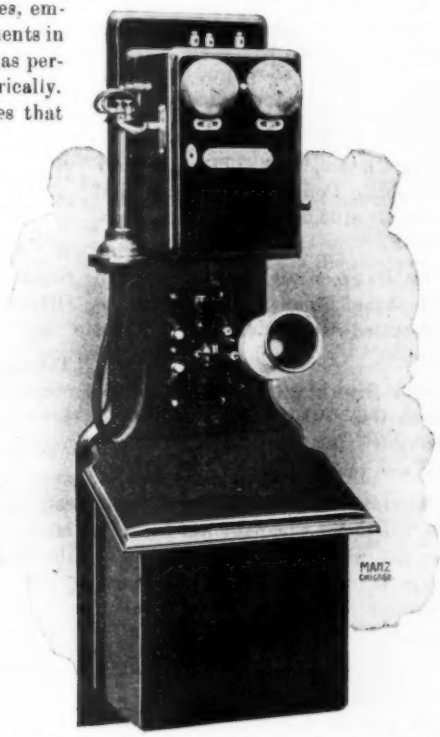


FIG. 3.—WESTERN TELEPHONE CONSTRUCTION COMPANY'S STANDARD ROCKER ARM TELEPHONE.

In Fig. 1 is shown a new cabinet desk set, finished in either oak or cherry. The transmitter is of the long-distance, granular-carbon type, mounted on a goose-neck arm, handsomely enameled. The working parts of the set are all exposed to view through a bevel-glass plate. They are all nickel-plated and finished in the best possible manner, so that they not only serve the purpose for which they are designed, but add materially to the appearance of the outfit. Evidently the company believes in the old saying, "Ornament your construction, but do not construct your ornaments." All the woodwork is of such high finish that the instrument makes a fitting addition to the furniture of any office or house, no matter how fine its surroundings. The generator and ringer are wound for either "bridged" or series work, as may be specified. The induction coil is of the regular Western long-distance type, with an extra fine finish. It bears inspection, both inside and out. The spool is made up of black fiber, wound, both primary and secondary, with best silk-insulated wire, no cotton whatever being used in its construction. Another point of note is that every contact point is of platinum. Fig. 2 shows a desk set of different design, made so far only in cherry. This seems to be essentially a set for the fairer sex, as in place of the plate-glass front a bevel-edge mirror is placed, so that the user may contemplate his or her own pleasant visage while waiting for the answering ring. In Fig. 3 is shown the company's standard rocker-arm telephone, recently modified and improved. So much has been written concerning the general features of this instrument that further mention would seem trite. It is claimed to be standard in all that the word implies, embodying all the latest improvements in teleph ne construction, and is as perfect mechanically as it is electrically.

Among the many accessories that enter into the equipment of a line or exchange, the Western Telephone Construction Company has always been foremost in producing such devices of the simplest and most efficient type. The distributing board, for instance, shown in Fig. 4, is a fair sample of the company's work, and in efficiency, compactness, ease of manipulation as well as handsome appearance, fully equals anything in that line of apparatus. It is more than its name implies, being a complete lightning arrester board, distributing board and a testing board. In conclusion, the writer wishes to express his thanks to Mr. Kempster B. Miller, the company's able engineer, for the courtesies shown in furnishing data and illustrations for this article.

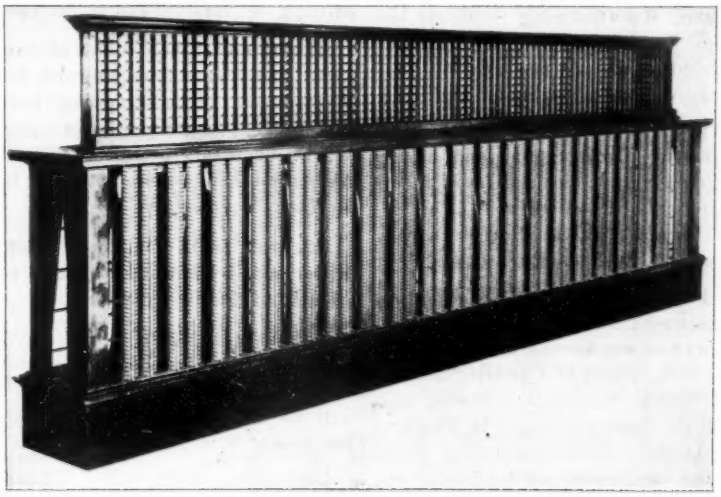


FIG. 4.—WESTERN TELEPHONE CONSTRUCTION COMPANY'S STANDARD DISTRIBUTING BOARD.

European Telephone Statistics.

United States Consul J. C. Monagham writes to the State Department from Chemnitz as follows:

In no department of industry is Germany more active than in electrical appliances. To our people, certainly the equal of any nation in this line, the following statistics will prove interesting. The list leaves out Norway, Denmark, Finland, Great Britain and Portugal, because these people put down no answers to the cards of inquiry; Turkey and Greece have no telephones.

Country.	Number of lines.	Instruments.	Inhabitants to each telephone.
Sweden	295	42,354	115
Switzerland	295	23,416	129
Luxemburg	57	1,356	160
Germany	534	131,577	397
Holland	31	7,900	615
Belgium	15	9,400	682
France	407	31,681	1,216
Austria	124	18,950	1,318
Spain	48	10,810	1,597
Hungary	36	8,458	2,168
Italy	54	11,615	2,629
Russia	53	16,050	6,988
Bulgaria	5	243	13,616
Roumania	6	397	16,042

If these states continue to improve their telegraphic and telephonic connections in the next decade as they have in the last, an enormous amount of wire and of instruments of all kinds are sure to be demanded.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

PETERSBURG, IND.—The Farmers' Telephone Company, with a capital stock of $5,000, has been incorporated. Directors, Byron Brenton, George E. King, Henry Read and William H. Limp.

LA CROSSE, WIS.—The Interstate Telephone Company, with a capital stock of $100,000, has been incorporated.

ST. PAUL, MINN.—The Crookston Telephone Company has been incorporated with a capital stock of $10,000.

BIG STONE GAP, VA.—The Big Stone Gap Telephone Company will probably extend their line to Coeburn, and also to Jonesville.

ALVIN, TEX.—The Alvin & Angleton Telephone Company has been organized, with A. J. Birchfield, president; O. S. Cummings, secretary-treasurer and F. J. Bush, general manager.

NASHVILLE, IND.—W. S. Daugherty & Company, of Columbus, have been granted a franchise to build a telephone line from Columbus to this place.

CANTON, S. D.—The Canton Telephone Company, with a capital of $10,000, has been incorporated; incorporators, C. E. Judd, F. H. Bocan, H. N. Cooper, C. B. Kennedy and C. M. Seelve.

RALEIGH, N. C.—The Edenton Telephone Company has been incorporated with a capital stock of $1,500.

BARTLETT, OHIO—The People's Telephone Company has been incorporated, and is authorized to build and operate a telephone line between Cutler, Ohio, and McConnellsville through the counties of Washington, Athens and Morgan; capital stock, $2,000; incorporators, A. W. Law, D. L. Fawcett, L. M. Penrose, L. W. Peebles and E. E. Hart.

SEDALIA, MO.—The Russell long-distance telephone line has been completed to this point, giving Sedalia communication with Warsaw, Benton County; Osceola, St. Clair County, and with several other towns in Benton, Henry and St. Clair counties.

COLUMBUS, WIS.—The Wisconsin Telephone Company will rebuild its line between this city and Watertown, putting in a metallic circuit, which will be placed in direct connection with the principal circuits of the East and West.

ADRIAN, MICH.—The Citizen's Telephone Company has completed contracts for the extension of its toll-lines to Blissfield, Riga, Deerfield, Palmyra, Hudson, Clayton and other towns.

RAVENNA, OHIO—The Ravenna Home Telephone Company has been incorporated. The incorporators are W. H. Butler, W. S. Krake, Dr. W. W. White, L. P. Seymour, D. F. Stocker and Mayor A. S. Cole. Officers will be elected in a few days.

TECUMSEH, MICH.—Tecumseh Telephone Company has been incorporated, with a capital stock of $10,000.

MANCHESTER, N. H.—The Automatic Telephone Company, with a capital of $125,000, has been incorporated. The company will operate in the New England States.

New Incorporations.

CLEVELAND, OHIO—The Ohio Carbide Company has been incorporated, with a capital stock of $10,000.

NEW YORK, N. Y.—The Burlington Light Company, to manufacture mantles or hoods for incandescent gas lamps, has been incorporated; capital, $1,000; directors, Louis Levien, Nathan Haisberg and S. A. Lehmann.

CHICAGO, ILL.—Western Telephone Manufacturing Company has been incorporated; capital stock, $2,000; incorporators, M. B. Kennedy, W. A. Bisland and S. C. Platt.

WASHINGTON, D. C.—The Capital Electric Construction and Power Company have filed articles of incorporation, with George P. Phillips, William W. Walker, Robert P. Murphy and Hal P. Hill as trustees.

EAST GREENWICH, R. I.—The East Greenwich Electric Lighting Company has been incorporated by Charles G. Hill, Frank C. Cundall, Thomas H. Galvin, Samuel M. Knowles, Russell V. Sharpe, Joseph S. Thornley and others, for the purpose of generating, conducting, selling, leasing and using electricity for lighting, heating and mechanical purposes, and for manufacturing, using and dealing in all machinery, electrical instruments, conductors, lamps, apparatus and appliances pertaining to the use of electricity. Capital stock is not to exceed $50,000.

NEW YORK, N. Y.—The S. V. Interior Telephone Company has been incorporated to manufacture electric devices; capital, $30,000; directors, Robert Y. Vassar, of 44 West Twentieth street, and J. G. Smith, of New York city; J. D. Anderson and W. B. Dall, of Brooklyn, and C. C. Bean, G. S. Tait and C. A. Dall, of Montclair, N. J.

NEW YORK, N. Y.—The American Electrical Novelty and Manufacturing Company has been incorporated; capital, $25,000; directors, Conrad Hubert, Maurice Hartman and Joseph Horwich, of New York city.

LANCASTER, PA.—The George C. Towle Manufacturing Company has been incorporated to manufacture electrical machinery; capital, $5,000; directors, G. C. Towle, J. E. Hubley and R. Blickenderfer, Lancaster; G. A. Towle, Lowell, Mass., and J. P. Williams, of New York.

Electric Light and Power.

MOBILE, ALA.—The People Light and Heat Company has been organized for the purpose of lighting and heating by the Kitson Hydrocarbon system. The capital stock is $100,000. The board of directors of the new concern elected S. T. Prince, president, and James K. Glennon, secretary and treasurer.

CANON CITY, COLO.—The Canon City Ice, Light and Power Company has been incorporated, with a capital stock of $100,000, by H. H. Sheppards, S. M. Shattuc and H. H. Lee.

MONTGOMERY, ALA.—The Mutual Light and Power Company and the Montgomery Light Company have consolidated and reorganized, electing W. F. Vandiver, president; C. G. Abercrombie, vice-president, and B. S. Maultsby, secretary.

DALTON, GA.—W. S. Pruden, Mayor, may be addressed concerning erection of electric light plant.

GREENVILLE, MISS.—The Mayor may be addressed concerning erection of electric light plant. An election will be held by the city to vote on issuance of $30,000 in bonds.

GONZALES, TEX.—The Citizens Electric Light and Power Company has been incorporated by W. M. Fly, August Klein, Jr., W. B. Houston, J. P. Randle, L. Brenner, Charles Beringer and J. D. Sayers, Jr.; capital stock, $5,000.

PINE BLUFF, ARK.—City Clerk may be addressed concerning construction of street railway, also an electric light plant.

MARION, VA.—B. W. Dinsmore has franchise for lighting the city, and will erect plant of 400 incandescent lights, of 16 candle-power each.

MOUNT OLIVE, N. C.—J. D. Williams will build electric light plant.

ROCK HILL, S. C.—The Rock Hill Light and Power Company has been incorporated by A. R. Smith, David Huchison, R. T. Fewell and James W. Cherry, to establish and operate a system of waterworks and an electric light and power plant; capital stock, $50,000.

SUFFOLK, VA.—J. W. Hosier may be addressed concerning proposed municipal electric light plant.

New Electric Railways.

BENTON HARBOR, MICH.—Col. George H. Ellers and Milton Weston, of New York city, have applied for a franchise for an electric road to enter this city. The road will extend to Sister Lakes, Dowagiac, Decatur, Paw Paw, and possibly to Kalamazoo, and will be in operation by July 4.

EASTWOOD, N. Y.—The Eastwood & East Syracuse Railroad Company has been incorporated, with a capital of $200,000, to operate a street surface electric road, two and one-half miles long, from this place to East Syracuse, in Onondaga County. The directors are A. J. Belden, J. A. Seely, C. M. Warner, G. E. Warner, Edward Joy, A. P. Fowler, F. J. Webb, M. C. Pierce and C. S. Carr, of Syracuse.

LOS ANGELES, CAL.—The Traction Railway Company of this place will extend its road to San Pedro.

LEXINGTON, S. C.—An electric road will probably be erected to connect with Brookland and Columbia.

CHICAGO, ILL.—The Evanston division of the Chicago, Milwaukee & St. Paul intends equipping its Chicago terminal with electric locomotives.

ROCKFORD, ILL.—Rockford Railway, Light and Power Company has been incorporated; capital, $250,000. Incorporators, F. A. Poor, N. B. Poor, R. S. Clements.

Increase of Capital.

PITTSBURGH, PA.—The Allegheny County Light Company increased its capital stock from $1,500,000 to $2,500,000.

HAMBURG, N. Y.—The capital stock of the Buffalo, Hamburg & Aurora Electric Railway Company is to be increased from $200,000 to $400,000.

A London Electric Mail Van.

Since about February 1 the London Electrical Cab Company, under contract with the British Post Office, have been daily running a mail van between the general post office and Paddington. Between these terminal points two calls have to be made, one at the West Central office, and the other at the Western District office. Six journeys per day are made, representing a total distance of 35 miles. The total weight of mails carried is, of course, very variable, but it frequently exceeds a ton.

The cells used are of the E. P. S. Faure-King type, specially made for this purpose. Each cell is six and one-fourth inches square in plan and 10 inches high, and contains 11 plates, which have a capacity of 172 ampere hours at a discharge rate of 30 amperes. Forty such cells are used, always in series, giving a pressure of about 80 volts. The cells are carried in a single tray, which is slung under the bottom of the van by four suspension links, supported from the body of the van by helical springs under compression. The total weight of the battery is about 1,300 pounds. Through hinged doors in the floor of the interior of the van the motor is easily accessible. The latter is of the Johnson-Lundell two-pole iron-clad type, in which the field winding surrounds the armature. This type of motor the company find to be more efficient than the four-pole type hitherto used in their cabs.

There are two armature windings, two commutators and two series field windings on each motor. The brushes are of carbon, fed end on to the commutator by a simple flat spring. The capacity of the motor is about three and one-half horse-power, and the mean working current about 30 amperes. On the armature spindle is a rawhide pinion having 20 teeth, which gears into the central wheel of the differential gear, this wheel being provided with 62 teeth. To provide for the different speeds of the driving-wheels in negotiating curves, the countershaft is in two halves, each half being driven by differential gear. These countershafts run in self-aligning bearings, and each carries a sprocket-wheel having 18 teeth. Sprocket-chains connect these with the larger sprocket-wheels fixed to the driving-wheels, and bearing 120 teeth. Finally, the diameter of these rear or driving-wheels is three feet six inches. The many difficulties encountered in the tires have been met by the use of solid round rubber tires of small cross section. The controller admits of five combinations, which secures different speeds and tractive force: (1) all the windings on the motor, together with a resistance, in series; (2) the same, but with the resistance cut out; (3) the two field windings in parallel and the armature windings in series; (4) the fields in series and armature windings in parallel; and (5) the two field windings in parallel, connected in series with the two armature windings in parallel.

The motor may be reversed at the slow speed by placing the regulator handle back of the neutral or top notch. The action of putting on the brakes also puts the motor out of circuit, so that the latter never works against the brake.

A key is provided by which alone the cells are connected to the regulator, and by which the driver is enabled to leave the van "out of gear." The turntable, to which the front two wheels are attached, is provided with a toothed wheel; this gears into a pinion on a vertical spindle, on the upper end of which is fitted a worm-wheel gearing into a worm operated by the driver's steering-wheel. It may be added that the laminated type of sprocket-chain hitherto used on the cabs is being replaced by a chain closely resembling the ordinary bicycle sprocket-chain.

The daily service of six journeys is performed with one battery charge, and has, so far, been characterized by perfect punctuality—an essential feature in a mail service. The maximum speed of the van is from 10 to 11 miles per hour on the level road.—*London Electrician.*

Continuous Advertising Pays.

One-time insertions seldom pay. The publisher knows this as well as does the advertiser who has learned it by sad experience. He should impress this fact on the advertisers from whom he solicits business. There are few periodicals, however, strong enough to resist the temptation to take everything offered them without regard to the advertiser's best interests. The advertiser who has tested it knows that it usually takes several insertions of an ad. to arouse the interest of the readers of a periodical. It is continuous advertising that pays. —*Advertising Experience, Chicago.*

The Brooklyn, N. Y., Rapid Transit Company shows the following increases in gross earnings for the days named: March 11, $2,653; 12, $1,837; 13, $2,836; total three days, $7,326.

Kindred.... ...Interests

The Jandus Electric Company, of Cleveland, Ohio, have received from the Navy Department at Washington a rush order for arc lamps. The order is for the Jandus (formerly known as "Manhattan") enclosed arc lamps, and is a very large one.

The Commercial Cable Company announces the opening of the new cable line to the West Indies via Bermuda. The Direct West India Cable Company has just completed its cable to Turks Island and Jamaica, and the reduction of rates lately made is due to the establishment of this new line. The Postal Telegraph company works in connection with this system.

The Hartford City Gas Light Company, of Hartford, Ct., have placed another contract with the Berlin Iron Bridge Company, of East Berlin, Ct., for one of their steel roofs, lined with their patent anti-condensation fireproof roof lining, which has given the gas light company such eminent satisfaction in the past. The new building is about 35 feet wide and 70 feet long, having brick sides and iron roof constructed as mentioned above.

Catalogue No. 5 for 1898, just issued by Farr Telephone and Construction Supply Company, Chicago, should more properly be called a handbook of information, because, in addition to a complete list of telephone apparatus and supplies, it contains a number of diagrams, tables and formulas which will be appreciated by all telephone and other electrical men. In addition, a list of the most important telephone patents is given, designating the device patented, with date of expiration.

Attention is called to the announcement of the Brown-Pierce Company, Dayton, Ohio, beginning with this issue. This concern make a specialty of fine machine designing and engraving by all processes. They have done a great deal of electrical machine engraving, and have had large experience along this line. They have been established some years now, and enjoy a rapidly increasing business owing to the splendid quality of their output. They have illustrated some of the very finest recent catalogues published by manufacturers of electrical machinery as well as other lines. This house should be considered when high-class work is required.

The Western Electric Company —There has been some criticism in regard to the Western Electric Company's advertising a swinging-tree insulator when the snow was on the ground. But the circulation of the ELECTRICAL REVIEW extends from the most southern point of the civilized world to the most northern, and now is the time of year for at least 50 per cent of the central stations in the United States to look after their outside lines and prevent them from coming in contact with the trees. The Western Electric Company have recently made a number of shipments of interior conduit and fittings. They always keep on hand a large and complete stock of conduit to meet all demands. This company advertises that they will send a small sample roll of simplex tape to any one writing for the same.

A belt dressing—It is the slipping heel that wears the hole in the stocking, and it is the slipping belt that wears the leather. Belts that slip not only do not drive properly, but they wear out rapidly. A belt that is too tight is overstrained, and will also wear out rapidly. A thoroughly reliable belt dressing is therefore a necessity in every well regulated factory, and probably no dressing has such a world-wide reputation as Dixon's belt dressing and leather preservative. As long ago as 1878 it was used on the big driving belt at the Paris Exposition, when every other means had failed to make the belt take hold of the pulley that was to start the thousands of feet of shafting and hundreds of machines. Those who use Dixon's belt dressing claim that it prevents slipping and thoroughly preserves the life and elasticity of the belt. It is made only by the Joseph Dixon Crucible Company, Jersey City, N. J., who are known the world over for their graphite products.

The Western Electric Company has recently issued Bulletin No. 25, descriptive of the Lakon transformer. This bulletin illustrates the iron stampings from which the transformers are built up; several different sizes of transformers and the methods of connecting them to obtain either 50 or 110 volts; also hanging device and special fuse-box. The Lakon transformers are made for long-distance transmission for the ordinary 1,000 and 2,000-volt primary, and 110 and 50-volt secondary for three-wire system and for arc-light transmission. They are all insulated, and can be run either as dry transformers or oil-insulated transformers. The Lakon transformers have no joints on the top or sides, the only joint being on the bottom, thus making the case thoroughly weatherproof without the use of cement or other material to fill up the cracks. The larger sizes are placed in either an open case for inside use or in weatherproof case for outside use.

New factory and office facilities have been established at Mill and Platt streets, Rochester, N. Y., for the Rochester Electric Motor Company. New machinery and manufacturing apparatus have been installed here, and the company is in a better position than ever to meet the growing

demand for their production of direct-current dynamos and motors. The present officers of the company are F. C. Kimmell, president; Edw. F. Davison, secretary and treasurer, and P. J McDonald, superintendent.

The Carborundum Company, Niagara Falls, N. Y., has sent out a handsomely printed booklet, containing expressions of opinions very flattering to carborundum from many of its users.

Elmer P. Morris, 15 Cortlandt street, New York, manufacturers' agent for electrical materials, has issued a very complete catalogue of electric railway supplies, which contains all the up-to-date appliances for this branch of the industry.

The St. Louis Electrical Supply Company, 911 Market street, St. Louis, Mo., has issued a satisfactory and well illustrated catalogue of telephones and telephone supplies. The apparatus catalogued covers the needs for every possible service.

The Keystone Electrical Instrument Company, Ninth street and Montgomery avenue, Philadelphia, has prepared catalogue No. 10, describing the Keystone switchboard and portable voltmeters, ammeters, wattmeters, ground detectors and other measuring instruments. The catalogue will be sent free on request.

The splendid telephone catalogue of 64 pages, published by De Veau & Company, 27 Rose street, New York, will interest every one who has any connection with the progress of telephony. This company will send one copy free to any one writing and mentioning the ELECTRICAL REVIEW.

Patterson, Gottfried & Hunter, Limited, 146 Centre street, New York, have sent to the editorial rooms of the ELECTRICAL REVIEW a booklet of interest to those identified with power and steam interests, completely illustrating rubber belting and rubber hose made by the World Manufacturing Company, for whom they are agents.

The swinging-ball lightning arrester, of which thousands are in daily use, is now being sold by James D. McIntosh, 150 Nassau street, New York. It is said that this arrester has never been known to fail when properly installed. This is a form of protection which every electric light, telephone, power and railway company should have. Circulars and descriptive matter will be sent on application.

The success and growth of the sales of the "Gordon" primary cells during the past few months are well illustrated by the fact that the Gordon-Burnham Battery Company, of New York, the manufacturers, frequently place orders for a car load at a time of carbons which are used in the battery. This company is also lessee of the Law Battery Company, the product of which has long been known in the electrical field.

The Wm. Kline & Company, of 123 Liberty street, New York city, are now placing on the market a high grade of miniature incandescent lamps. The lamps are being manufactured in a great variety of designs and colors, and they announce that they can promptly handle any orders calling for a special variety. A branch office under the charge of Mr. W. R. Garton has recently been established by the company at 414 Ashland Block, Chicago, Ill.

The National Pipe Bending Company, of New Haven, Ct., have issued a very tastefully prepared booklet describing the "National" feed-water heater, of which they have sold over 800,000 horse-power. This company, besides manufacturing "National" feed-water heaters, make coils and bends of iron, brass and copper pipe for all kinds of service. The illustrations and tables contained in the pamphlet give a great deal of information valuable to steam users.

The following is a list of a dozen representative establishments which have recently installed "Pioneer" arc lamps, made by the Electric Arc-Light Company, New York: Edison Electric Illuminating Company, Siegel-Cooper Company, New York; Abraham & Strauss, Brooklyn; Jas. A. Hearn & Son, Meyer Jonasson & Son, Seventh Regiment Armory, Columbia University, New York; Jos. H. Bauland Company, Brooklyn; Henry Heide, New York; Root, McBride Company, Cleveland, Ohio; Callender, McAusland & Troup Company, Providence, R. I.; Flint & Kent, Buffalo, N. Y.

The Warren Electric and Specialty Company, of Warren, Ohio, have recently issued a very artistic prospectus, accompanied by a forcible circular apropos of the incandescent lamp situation. The scheme of the circular is to refute certain statements which had been previously made apropos of the quality of their product of incandescent lamps and the attitude as to their position in respect to other companies making incandescent lamps. The Warren Electric and Specialty Company are known to be doing a very large and growing business at the present time, and now have facilities to give immediate attention to further orders. Aside from the home office, this company is represented by W. S. Hull, 167 Dearborn street, Chicago, and by Mr. E. R. Frances, Minneapolis, Minn.

The Peru Electric Manufacturing Company, of Peru, Ind., owing to the rapid increase of its business, finds it necessary to make an addition to its already extensive manufacturing facilities. This will take the form of a new building, 70 feet long and 25 feet wide, about half of which will be two stories in height and the other half one story high. A porcelain kiln, surrounded by an iron-clad building thirty feet square and one story high, has just been completed, and will soon be pressed into service. This makes five kilns now included in the plant. At present the company is enjoying a boom in trade, and has a force of nearly a hundred persons at work. The plant is one of the most thriving in Peru. The present officers are: J. O. Cole, president; C. H. Brownell, vice president; R. H. Bouslog, secretary and treasurer; R. A. Edwards, J. O. Cole, C. H. Brownell, J. G. Brackenridge, William B. McClintic, directors.

The "Fernseher" Can See Around Corners.

Under date of London, March 17, the New York *Sun* printed this special cable dispatch:

"The Vienna correspondent of the *Daily News* has had an interview with Herr Szczepanik, the inventor of the Fernseher. Herr Szczepanik said in the interview that it is possible, not only to adapt the Fernseher to the instantaneous reproduction of manuscripts, but to print them on photographic plates at any distance. For instance, a newspaper, as it leaves the press in Vienna, can be inserted in the apparatus and reproduced the next moment in New York. Herr Szczepanik predicts that telegraphs and telephones will thus be completely superseded."

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Hatton Garden, London, England.

FOR SALE

A complete street lighting plant to operate 250 24-C.-P. Series Incandescent lamps, consisting of one 12x12 Ideal Engine, nearly new; one I. B. Davis Pump, No. 2; one Berryman Heater, 150 H.-P.; two Mather Series-Wound Dynamos, Capacity 125 24-C.-P. Lamps, each, together with shafting, pulleys, switchboard, etc., will be sold in whole or in part; also two 125-H.-P. Westinghouse Automatic Engines, in use less than a year; one 75-H.-P. Westinghouse Junior Engine, in use less than a year; one Horizontal, 14x42 Corliss, 75 H.-P., in good order. The above will be sold at a bargain, as the Company have no further use for same. Address

THE MANCHESTER LIGHT & POWER CO.,
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FOR SALE—AT A BARGAIN.

Two M. P Railway Generators, 175 H.-P.; speed, 550 revolutions for 550 volts; also 220 and 110-volt dynamos and motors, switches and instruments. Apply to

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Bargains in Dynamos, Engines, Etc.

Direct current dynamos of 350, 700, 725, 800, 810, 900, 1,075, 1,350, 1,610 and 2,500 light capacity.
Alternating-current dynamos of 750, 900, 1,800 and 2,000 light capacity.
Arc dynamos, 30, 24, 30, 40, 50 and 60 lights, both 1,200 and 2,000 candle-power.
Engines, 50, 75, 85, 100, 115, 125, 150, 175 and 200 horse-power.
Boilers, 100, 250, 375 and 500 horse-power.
Heaters, 150 and 2,000 horse-power.
Pumps, all sizes.

Write us for Price-list No. 21.

This apparatus has been removed from our own Central Stations to make room for larger units. We therefore know its history and can guarantee it to be in thoroughly good operative condition.

CHICAGO EDISON COMPANY, 139 Adams St., CHICAGO.

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED MARCH 15, 1898.

600,509 Controller for electrically propelled vehicles; R. D. T. Brougham, London, England—A switch lever, a slot in it, a foot lever, a pin carried by it working in the slot, a brake lever and a flexible connection between the foot and break levers.

600,523 Quick-break electric switch; T. E. Drohan, Chicago, Ill.

600,527 Depressible rail system for electric railways; W. Grunow, Jr., Bridgeport, Ct.—An electrical contact system, consisting of contact receptacles having a tubular projection formed in the cover thereof, and being provided with a mercury receiver, connections between the receiver and source of electrical supply, a sleeve movably mounted in said tubular projection and having outwardly directed arms, means for supporting said arms, a contact device carried by said sleeve, and a depressible rail connected with the contact device and adapted to be charged when depressed.

600,564 Protective appliance for electric railways; L. E. Walkins, Springfield, Mass.

600,593 Cut-out; A. R. McNeill, Oldfields, W. Va.—Consists of an interrupted main line, a support, a single pair of contacts for the terminals of the main line carried by said support, a short line carried by an arm and normally out of contact with the main line, a local line carried by a second arm also normally out of circuit with the main line, and means for moving either arm and bringing either of the lines into circuit with the main line terminals.

600,607 Insulator support for electrical conductors; F. Benedict, Niles, Mich.

600,616 Alternating-current meter; G. Hummel, Munich, Germany—In an alternating-current meter, the combination of an iron stator of substantially U shape, a rotor, shunt and series coils acting upon the stator, and an adjustable armature or keeper for regulating the shunt magnetic flux, whereby the magnetizations due to the coils may be brought into approximate quadrature.

600,719 Galvanic battery; E. Habermann, Michigan City, Ind.—Consists of superposed battery elements, of a wick disposed between and in contact with both elements, and an exciting fluid isolated from the elements and in which a portion of the wick is immersed.

600,743 Automatic safety circuit closer and cut-out; W. L. Pratt, Adams, N. Y.—Comprises hinged arms carrying loop connections, said arms being held normally in circuit by a fuse-wire, a plate through which the current passes and which acts as a magnet, a pivoted armature mounted upon said plate, and a needle or pointer also pivoted upon the plate co-operating with the fuse wire.

600,850 Primary battery; J. E. Fuller, New York, N. Y.

OBITUARY.

Sir Henry Bessemer, whose processes for converting iron into steel revolutionized the iron industry, died in London on March 15. He was born in Hertfordshire in 1813.

Edgar L. Ridgway, vice-president of the Consolidated Telegraph and Electrical Subway Company, of New York city, died at his home in Bronxville, N. Y., on March 15. He was born in New York city in 1846, and was prominent in public and political life. In 1886 Mr. Ridgway was appointed an Aqueduct Commissioner, which position he resigned in 1889, when Governor Hill appointed him Commissioner of the State Board of Emigration. On the organization of the board Mr. Ridgway was elected president, a position he held for several years. Mr. Ridgway wrote several articles on political economy and the immigration question.

Jules Viennot, a well known advertising agent, died at his home in Philadelphia on March 11, after a brief illness, in his seventy-third year. Mr. Viennot was born in Paris, and came to this country about 40 years ago. Some 20 years later he reached Philadelphia and established himself in business at 524 Walnut street, where his office still stands. He was a member of the Franklin Institute and of the French Benevolent Association. About two years ago he had the honor of Officier de l'Academie bestowed upon him by the French Government. Mr. Viennot conducted one of the largest advertising agencies in the country, and by his strict integrity and upright dealings he had been able to number among his clientage numerous large firms. A widow and daughter survive him. The business he established will be carried on as usual.

Fresh Office Boy's Fun with the New Boy.

[*From the Philadelphia Record.*]

The office boy in the reporters' room has been encouraged to try again. Here's his latest: "A fresh boy in the office of an uptown business concern had some fun the other day with the green office boy who had his first day to work. When the newcomer came to work the boy was told by the foreman the work he was supposed to do. Forgetting something the boss had told him, he thought he would ask his partner, whose name was Johnnie. Going to him he said: 'The boss told me to take a bucket to the cellar and get something, but I can't remember what it is.' 'Oh! I will tell you,' said Johnnie. 'He wants you to go to the engineer and get a bucket of steam; if he ain't got steam, get electricity.' The boy journeyed to the cellar, and tried to explain to the engineer what he wanted, but the engineer could not understand, and, after getting a little rattled, he yelled to the green hand to go up and see if he didn't make a mistake, and wanted a left-hand monkey wrench instead. The boy went home that night, but has not yet returned."

In his statement to the court asking for a receiver, C. C. Warren, president of the Warren Electric Company, of Illinois, says that the total assets of the company, aside from the indebtedness, will not exceed $6,000, and the liabilities amount to $12,000.

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For all Open-Circuit Work. Especially adapted for Electric Bells, Burglar and Fire Alarms, Telephones, etc.
Write for testimonials and sample battery.
Burnley Battery & Mfg. Company,
PAINESVILLE, OHIO.
Foreign representatives: Electrical Construction Corp'n and General Electric Co., London, England.

LYONS & BISSING.
MR. JOSEPH LYONS, Electrical Expert and Solicitor, and *MR. GUSTAV BISSING, late Principal Examiner of Electrical Division A, U. S. Patent Office* announce the formation of a partnership for the general practice of PATENT LAW, with its offices at the McGill Building, WASHINGTON, D. C.

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Send me a model or drawing of your invention, and a description, and I will examine same and advise you promptly. My fees are moderate in all Patent matters, and I can obtain a Patent in the shortest possible time.
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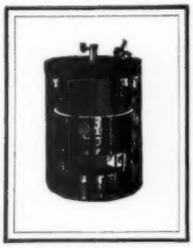
The increasing popularity of the Gordon Primary Cell among the Fire Alarm and Police Signal Service of the leading cities, the railroad, telegraph and telephone companies, and the general adoption of our steel enameled cell for gas-engine, launch and marine service attest most highly to its merit, efficiency, adaptability and economic features.
If you wish to read the testimonials in its behalf, and learn its full description, kindly apply for circular and price list, to
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actually reduces oil bills 50 per cent. or more. Sent on approval. Capacities ranging from 3 to 120 gals. per day. Used in 17 countries. It is specially adapted to Electric Light and Power Plants. Established eight successful years.
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ALL KINDS. COMMUTATOR SEGMENTS ASSEMBLED READY FOR USE. ARMATURES REWOUND.
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LITERARY.

The next installment of C. A. Dana's "Reminiscences" (in the April *McClure's*) will give Mr. Dana's impressions of Lincoln and the several members of the Lincoln Cabinet—particularly Seward and Chase—as Mr. Dana saw them officially and socially, day and night, during the most exciting part of the war. The paper will be illustrated with portraits from the government collection of war photographs.

The Chicago Electrical Association has issued in pamphlet form the report of its Committee on Standard Diagrams for Uniformity in Electrical Engineering and Patent Office Drawings. The diagrams are published in a convenient pocket form, and, to cover the expense of printing, the nominal price of 10 cents a copy is charged. The pamphlets may be obtained by addressing J. R. Cravath, secretary of the Chicago Electrical Association, 825 Monadnock Building, Chicago.

"ELECTRICITY AT THE COLUMBIAN EXPOSITION."

A Chance to get an Interesting Book at Small Cost.

It is now nearly four and one-half years since the close of the great World's Columbian Exposition, held in Chicago. Every vestige of the famous electrical display at which the people gazed and wondered has disappeared. The people have gone, the buildings have been removed, the drives and walks changed and the Exposition grounds once more transformed into a beautiful park.

Electricity at the Columbian Exposition, however, lives not only in the memories of the people who have seen it, but also in a more substantial form in the shape of a five-hundred-page book compiled by John P. Barrett. This book, "Electricity at the Columbian Exposition," contains eighty-four handsome full-page illustrations, sixteen of which show exterior views of the buildings at night. The brilliant illumination of the buildings by both incandescent and arc lights made it not only possible to photograph them after nightfall, but also gave unique and artistic results. Seventeen of the full-page illustrations are general views giving pictures of the fountains and statuary, and there are also fifty full-page pictures of the various exhibits.

The paper used in this book is finely finished enameled book paper, which allows for the best effect in printing illustrations. The text is generally descriptive of the various exhibits and of the buildings, and also contains several reports of the expenses and the operation of the intramural railway, and several short historical introductions to the descriptions of the various departments of electricity.

The price of this book, bound in cloth, is $1.00. It is supplied by the

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41 Park Row (Times Building), New York.

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Special Connectors for HARD-DRAWN COPPER WIRE, *All Sizes.*
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are made in all styles and grades and are just the thing for TIME PLANTS for FACTORIES, SCHOOLS and PUBLIC BUILDINGS. Our specialty is everything electrical in connection with clocks. We make PROGRAM clocks, TIME SWITCHES, MASTER clocks, ELECTRIC clocks, CALENDAR clocks and SIXTY-DAY clocks.
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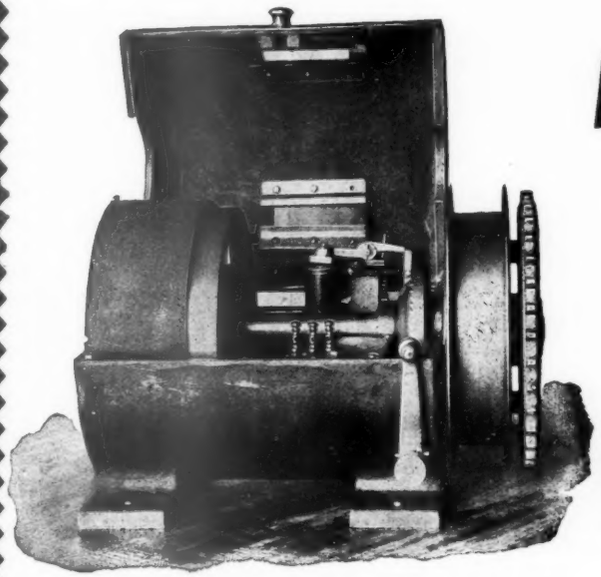

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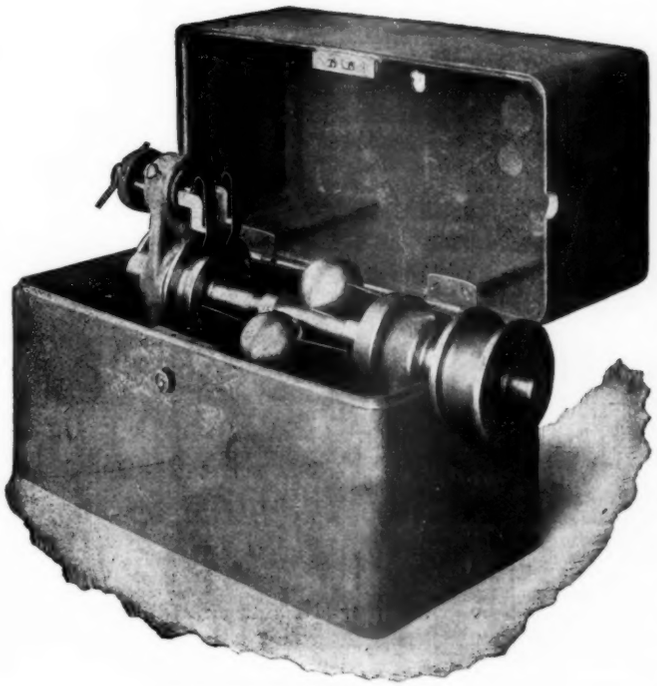

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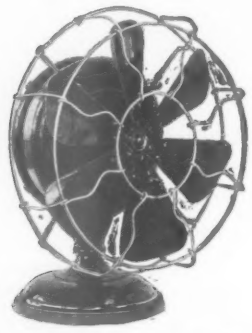

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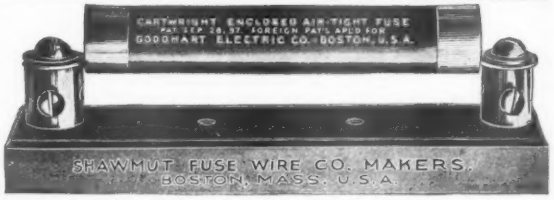
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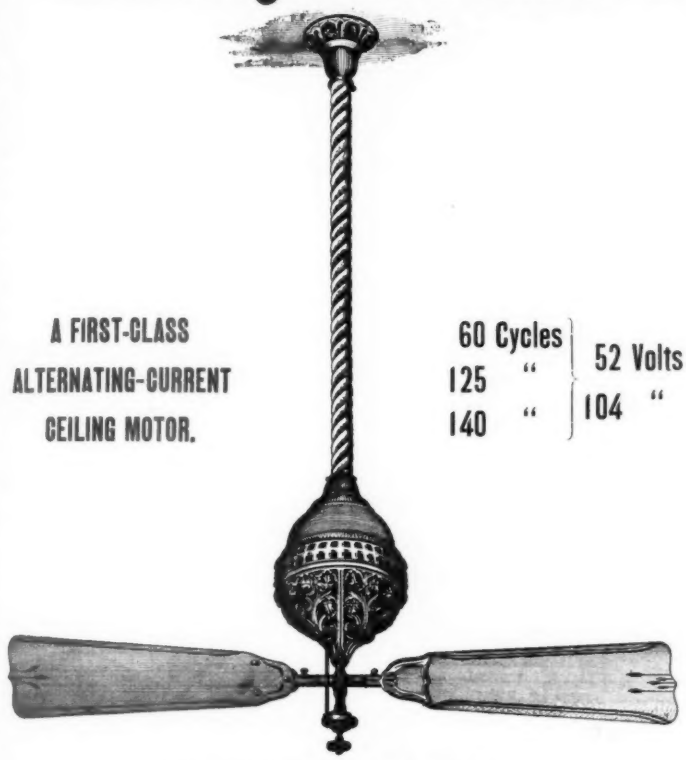

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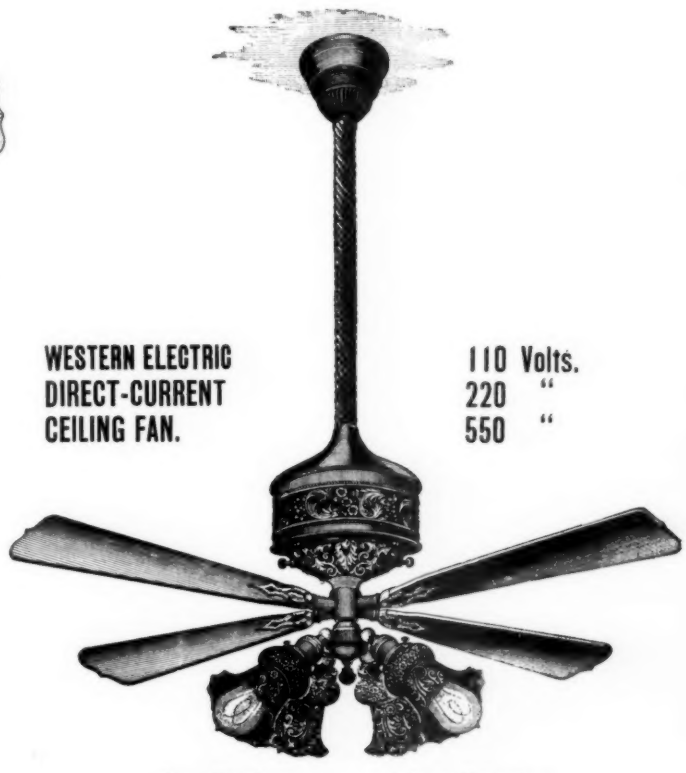

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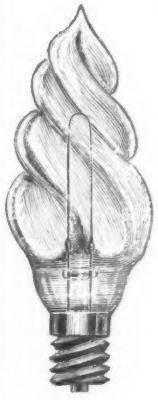

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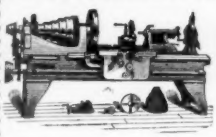

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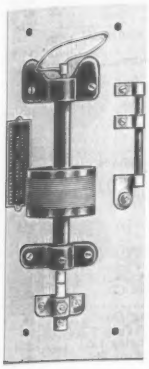

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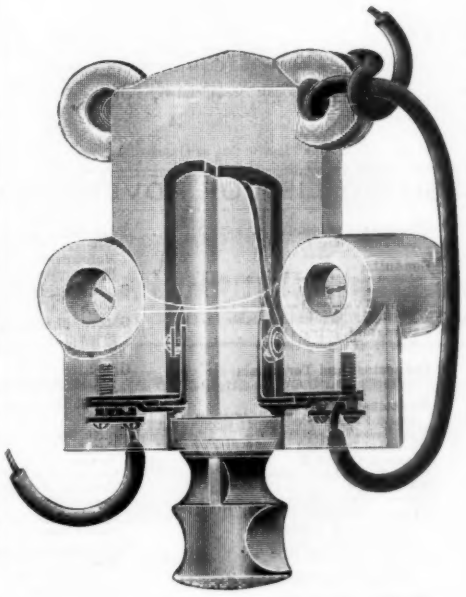

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Eddy Electric Mfg. Co.
Fort Wayne Electric Corporation.
General Electric Co.
Goldmark & Wallace.
Sprague Electric Co.
Stanley Electric Mfg. Co.
Walker Co.
Westinghouse Electric & Mfg. Co.

Electrical Elevators.
Otis Brothers & Co.

Electrical Show.
Electrical Exhibition Co.

Electric Locomotives.
General Electric Co.

Electric Novelties.
Manhattan Electric Supply Co.
Rodrigues, M. R.

Electrical Instruments.
Central Electric Co.
General Electric Co.
Cherry Electrical Works.
Keystone Electrical Instrument Co.

Electrical Supplies.
Bibber-White Co.
Bunnell & Co., J. H.
Central Electric Co.
Electrical Appliance Co.
K. & W. Co.
McKinlock & Camp.
Novelty Electric Co.
Partrick, Carter & Wilkins.
Peru Electric Mfg. Co.
Pettingell-Andrews Co.
Royce & Marean.
Sterling, C. B., & Co.
Western Electric Co.

Engineers and Contractors.
New England Engineering Co.
White & Co., J. G.

Engineers, Consulting.
Nagle & Ball.

Engines.
Armington & Sims Co.
Ball & Wood Co.
Monarch Mfg. Co.

Fans and Fan Motors.
Central Electric Co.
Diehl Mfg. Co.
General Electric Co.

Fixtures, Gas and Electric.
McKenney & Waterbury.

Fuse Wire and Links.
General Electric Co.
McIntire Co., The C.
Shawmut Fuse Wire Co.

Gas-Lighting Apparatus.
Bogart, A. L.

Globes, Shades, Etc.
Frink, I. P.
Phœnix Glass Co.

Graphite.
Dixon Crucible Co., Jos.

Ground Detectors.
Wood & Comer, Ltd.

House Goods.
Central Electric Co.
Eyanson & Armpriester.
Ostrander & Co., W. R.
Partrick, Carter & Wilkins.
Pacific Electric Co.

Incandescent Lamps.
(See "Lamps.")

Instruments (Testing and Recording.)
Bristol Co., The
Cherry Electric Co.
General Electric Co.
Keystone Electrical Instrument Co.
Wagner Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.

Insulators and Insulating Material.
Central Electric Co.
Empire China Works.
Imperial Porcelain Works.
Locke, Fred M.
Standard Underground Cable Co.
Standard Paint Co.
Sterling Supply & Mfg. Co.

Lamps, Arc.
Brush Electric Co.
Diehl Mfg. Co.
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General Electric Co.
General Incandescent Arc Light Co.
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Jandus Electric Co.
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Lamps, Desk.
McLeod, Ward & Co.

Lamps, Incandescent.
Buckeye Electric Co.
Columbia Incandescent Lamp Co.
Edison, Jr., Thos. A.
Edison Min. & Dec. Lamp Dept.
General Electric Co.
K. & W. Co.
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Sawyer-Man Electric Co.
Warren Electric & Specialty Co.
Westinghouse Electric & Mfg. Co.

Launches, Electric.
Electric Launch Co.

Lightning Arresters.
General Electric Co.
McIntosh, James D.
Westinghouse Electric & Mfg. Co.

Machine Tools.
Davis & Eagan Machine Tool Co.

Magnets.
Splitdorf, C. F.
Varley Duplex Magnet Co.

Mast-Arms.
Brady, T. H.

Mica.
Schoonmaker, A. O.
Munsell, Eugene.

Non-Magnetic Watches.
Becken, A. C.

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Burt Mfg. Co.

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Duvall, Edw. S.
Lyons & Bissing.

Pattern Letters.
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McNaughton Co., J. C.

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Imperial Porcelain Works.

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American Stoker Co.

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Central Electric Co.
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Hill Electric Co., W. S.
Western Electric Co.
Western Telegraph Construction Co.

Switches, Etc.
Automatic Switch Co.
Central Electric Co.
Eyanson & Armpriester
General Electric Co.
Hart & Hegeman Mfg. Co.
Newton Appliance Co.
Paiste Co., H. T.

Telephones.
American Bell Telephone Co.
American Elec. Telephone Co.
De Veau & Co.
Farr Telephone Construction & Supply Co.
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Mianus Electric Co.
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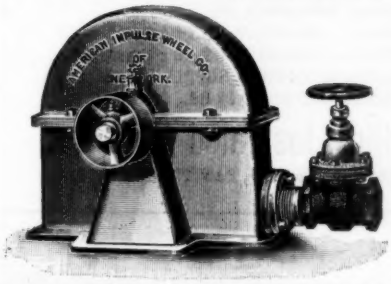

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